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Stoping Methods at the Golden Cross Mine

By Andrew W. Newberry*

SYNOPSIS—At the Golden Cross in Imperial County, Calif., development and stoping are conducted under the unfavorable condition of flat dips and vertical faulting at right angles to the strike. Workings are dry, however, and orebodies of good width. Depletion of ore reserves by previous operation prohibits elaborate methods of mining. Simple but ingenious scheme worked out for handling material on the flat dips, using fixed steel chutes. Development involves "dip raises" and "crosscut raises." Costs of drifting, raising and stoping.

The Golden Cross mine, along with its neighbors, the Golden Crown and Golden Queen, is situated in the arid region of southeastern California, 15 miles northwest of Yuma. All three mines were operated extensively in the past, and produced a large tonnage of medium-grade ore from which only a fair extraction was made. All are accessible, but the Golden Cross was selected by the present operators after careful sampling of the group, and has produced steadily since Oct. 1, 1913, the rate at present being about 90 tons per day. Some of the surface arrangements are illustrated in Figs. 1, 2 and 3, furnished by D. Hanson, assayer at the Golden Cross.

Fig. 1. Surface Plant

Crusher building on right in foreground. Outcropping aplite dike behind headframe

Fig. 2. Collar of Incline

Skip and 200-ton bin

General Geology

The country rock is a gray mica-schist stained brown at the surface and outcropping in the low hills known as the Chocolate Range. The schist has been extensively intruded by aplite, which is locally known as pegmatite, although the latter term is strictly applicable only to the larger dikes. The beds have a fairly uniform dip, varying from 32° near the surface to 24° at a depth of about 1000 ft. The deposition of the ore followed certain layers which were subsequently faulted so as to give the impression of separate and distinct oreshoots, whereas in reality only one shoot of ore has been definitely proved. The aplite intrusions already mentioned are later than ore deposition, and the faulting, which affects both the dikes and mineralized strata, is later than both. The principal fault planes are nearly vertical and approximately perpendicular to the strike. Hence they cut the orebody (assuming that there was originally only one mineralized bed) into blocks which are fairly continuous on the dip. Displacements up to 150 ft. have been noted in connection with the stronger faults. Between two of the more important faults or between one of them and the end of the oreshoot, step faults, roughly parallel to the major fault, are not uncommon. These show displacements up to 12 ft. with little or no fault breccia, so that their exact position is often difficult to determine until the ore is found on both sides. As the ore is similar in appearance to the altered or silicified country rock, close sampling is necessary. The occurrence of step faults and their relation to the major fault is illustrated in Fig. 4, which is a section along the strike and perpendicular to the dip of part of the orebody looking upward on the dip. The manner in which it is taken is shown in Fig. 6.

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Method of Development

The main incline, through which the mine was originally opened, is 1250 ft. in depth on a dip of 30°. Although the bottom is approximately at sea level, the sump is dry. Stations and 20-ton ore pockets are located at 100-ft. intervals along this shaft, which with depth passes out of the ore zone at its western extremity. Most of the mining is now carried on below the 600-ft. level, where the shaft lies wholly in the country rock and where the strata have an average dip of 26°. Assuming this dip and an average thickness of 10 ft. for the oreshoots below the 600-ft. level, which is a close approximation, the level interval in the stopes, or the distance between haulage drifts on the dip, figures out at 113 ft., the additional 13 ft. being accounted for by the difference between the 30° dip of the shaft and the 26° dip of the oreshoots.

At the time that present operations were begun, most of the levels had encountered the ore, and maps and models has been made which greatly facilitated the driving of new drifts and the extension of those which had

Fig. 3. Mill and Belt Conveyor, Looking Northwest

not yet reached the ore. Referring to Figs. 4, 5 and 6, which are typical of a level where further drifting was necessary to cut the oreshoot; section *C* is first developed by drifting along the foot wall; the foot and hanging of sections *A* and *B* are then determined by "crosscut raises" driven perpendicular to the bedding and sampled by means of the stoping drill, as described in the Journal, Apr. 4, 1914, under the title, "Drill Hole Samples in Raising."

Section *D*, having been proved on the level immediately above, is developed by a branch drift or crosscut from the haulage level in question. This is best driven from *C*, giving opportunity to raise at *P* and possibly also at *Q* and mine the upper part of *D* through these raises. It would also be possible to crosscut from *A* and shorten the tram, but this would not permit mining through *P* and *Q*.

Section *A*, which, on the level in question, is of greater importance than *B* or *C*, is developed in the same manner as soon as the foot wall of the orebody has been definitely determined by the crosscut raise. That portion of section *B* which lies below the crosscut raise, would ordinarily be left as a pillar until *A* and *C* are stoped out. The upper part of *B* is stoped along with *A* and *C*, the broken ore going to a chute which is built in the crosscut raise, except that portion to the right of *MN*, which is handled most economically through stope *C*, provided the face of the latter stope is kept somewhat in advance of *B*, as stoping proceeds up the dip. The manner of this development is shown in plan and section, Figs. 4, 5 and 6.

None of the fractional oreshoots left by previous operations is sufficiently large to warrant the installation of mechanical appliances for ore handling, such as shaking chutes or gravity planes, in the stopes themselves. Nor is the grade of the ore, which runs on an average from $7 to $10, high enough to justify such means. The dip of the beds is too flat to permit the broken ore to slide by gravity even on steel chutes set at the dip angle, and is too steep for wheelbarrow work. Various combinations of wheelbarrow and fixed chute were tried and the method described under the head of "stoping" was finally evolved, with minor alterations to fit special cases.

Dip Raises

In the upper part of the mine where the dip of the formation exceeds 30°, it has been found expedient to connect two levels, through the orebody, by means of at least one 6x8-ft. "dip raise," the name locally applied to a raise which follows throughout its extent the dip of the strata. The principal object of such a connection is to afford ventilation. Of the various methods tried for the handling of broken material on a flat dip, the fixed steel chute was found most satisfactory and has been adopted throughout the mine. The dry ore with a considerable proportion of fines is found to slide best on a dip of 32°. At 30°, the fines have a tendency to hang up and block the chute, while at 34° the slide is so rapid that many of the larger pieces jump out. The ideal arrangement for long chutes was found to be a dip of 34° for the first 10 ft., flattening gradually to 31°, an average of about 32°. This arrangement, for obvious reasons, is only approximated in practice. With dips as flat as 30°, the raise is begun at the foot wall of the ore on the lower level and terminated close to the hanging wall on the upper level, giving an average inclination of 32° without breaking into the wall rock.

No Raises Where the Dip Is under 30°

Where the dip of the beds is less than 30°, and this is the condition under which most of the present operations are carried on, dip raises from level to level would have added considerably to the cost of mining. The scheme followed is to carry up the stope the full thickness of the ore for a distance of 60 to 70 ft., placing the chutes as shown in Fig. 8, and keeping them up to within shoveling distance of the face. When the stope has been advanced to this point, it is necessary either to install some means of forced ventilation, which is done in case the orebody is not developed on the level next above; or better, to drive a dip raise along the foot wall to hole into the drift on the upper level, which is the plan followed wherever possible. Such a raise is kept as small as is consistent with proper breaking, about 4½x6½ ft. The broken ore is handled in wheelbarrows which are run up on temporary ore fills and dumped into the chute. As the raise is advanced, successive cuts parallel to *EF*, Fig. 8, are taken off the hanging wall to provide head room, part of the broken ore being left as a temporary fill. In this way the wheelbarrow runway is flattened somewhat and the handling of the muck from the dip raise is facilitated.

Taking section *C*, of Figs. 4, 5 and 6, as an example,

stoping is begun at one end and a 4-ft. cut taken off the same height as the drift, using a one-man piston machine, the holes being pointed approximately up the dip. Fig. 7 illustrates the manner in which this first cut is made. After the first cut, the piston machine is replaced by a stoper and the ore next the hanging broken on 2x12-in. boards laid on the track level. The face is then carried upward on the dip full width with a series of cuts similar to the first except that the stoper is used. These latter cuts are somewhat shallower than the first, averaging about 3 ft. 3 in. When the face has been advanced 10 ft. over the full stoping length, a pair of 10x10-in. stulls is placed as shown at *R*, Fig. 8. These stulls are set 5 ft. 10 in. center to center and as near the middle of the stope as possible, allowing for the pitch of the oreshoot. Other

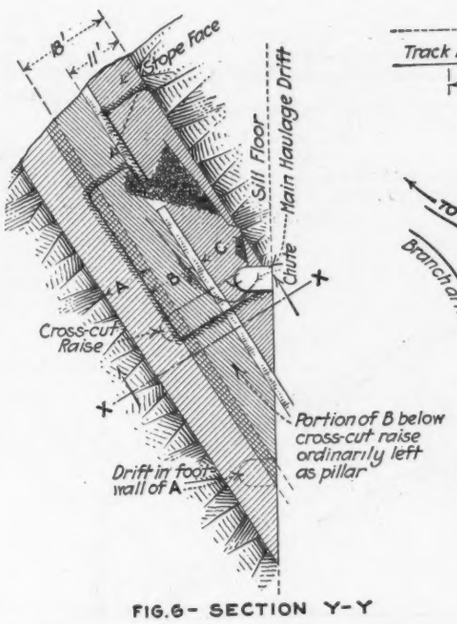


FIG. 6- SECTION Y-Y

PLAN AND SECTIONS, SHOWING RELATIONS OF RAISES, DRIFTS, CROSSCUTS AND STOPES

stulls, usually 8x8 in., are placed at intervals along the strike where needed. Pillars are left only in exceptional cases.

TELESCOPING CHUTES

When the stope face has been advanced four rounds (about 14 ft.), the bulk of the broken material no longer falls on the track. A steel chute *W*, Fig. 9, then serves for loading cars. The lower end of the chute rests on the edge of the car and the upper end is either supported by blocks to give the necessary inclination or suspended from a plug in the hanging by means of a clevis. In this way the trammer can load his own car. After the next cut has been made, the chute *V*, Fig. 9, is brought in and bolted inside of *W* with four ½-in. bolts. As the face is advanced, the chute is extended until the two parts overlap only 25 in., giving a total length of 17 ft. 11 in. Only one or two telescope chutes are used in a stope as they are readily moved from place to place.

The details of construction are shown in Fig. 9. Sheets of No. 10 tank steel 30 in. wide by 10 ft. long are bent cold and drilled with $\frac{5}{16}$-in. and ½-in. holes, spaced as shown. A chute similar to type *W*, but with the ½-in. holes drilled at each end only, is used for the fixed chutes referred to under dip raises. As only one, or at most two,

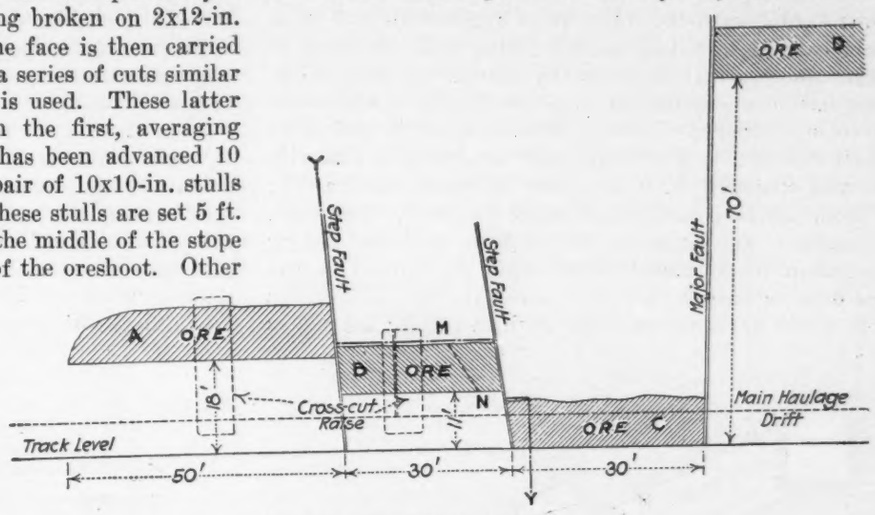


FIG. 4- SECTION X-X

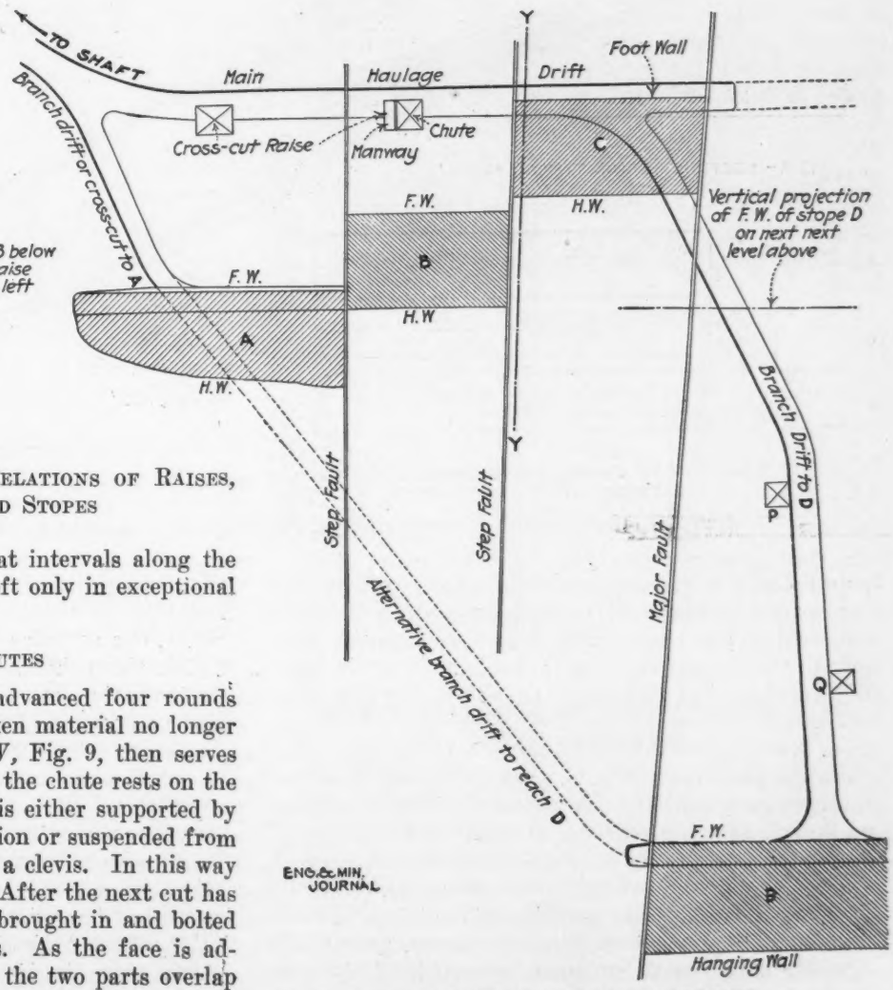


FIG. 5- PLAN OF MAIN HAULAGE LEVEL

stopes are brought in at one time, four of the inner chutes *V* answer for the whole mine and the bulk of the sheets are made up in form *W*.

Stoping Method

While the broken ore is being loaded by means of telescope chutes, the two 10x10-in. stulls *R*, Fig. 8, are tied with a 6x8-in. crosspiece and long bolt, and a shoveling platform *S* is constructed of 2-in. planking inclined downward toward the track on an angle of 10°. This is next covered with two sheets of tank steel of the same dimensions as that used for the chutes. As soon as the face has advanced too far to be reached by the telescope chute extended, the latter is done away with, and other pairs of stulls, *U*, Fig. 8, are placed, roughly in line with *R*, and spaced 9 ft. 9 in. center to center on the dip; 8x8-in. timber is used in all stulls except *R*. The pairs of stulls *U* are connected with 4x6-in. tiepieces, resting on 2x6-in. blocks nailed to the stulls, and turned so that the 6-in. surface in each case carries the two steel chutes *TT*, which are butt-connected at these points; the chutes ft. above the foot wall, is to lag against the stulls the full length of the stope and allow the broken ore to lie where it falls until a temporary fill is completed as shown in Fig. 8. This serves as a wheelbarrow runway for moving the ore from the ends of the stope. When a stope has been finished, these fills are mucked out.

The amount of ore tied up in this way is not large until the stope has been advanced 60 to 70 ft., and at this point, the method is varied somewhat. Stoping proper is stopped until the dip raise above mentioned has holed through. As the drills are operated only on the day shift, and the average daily advance is 2.5 ft., this requires about three weeks. Meanwhile, the ore over the raise is slabbed off as described under dip raises, to provide head room, and a narrow fill is made in the space later occupied by the main waste fill, as shown.

While the dip raise is in progress, some exploratory

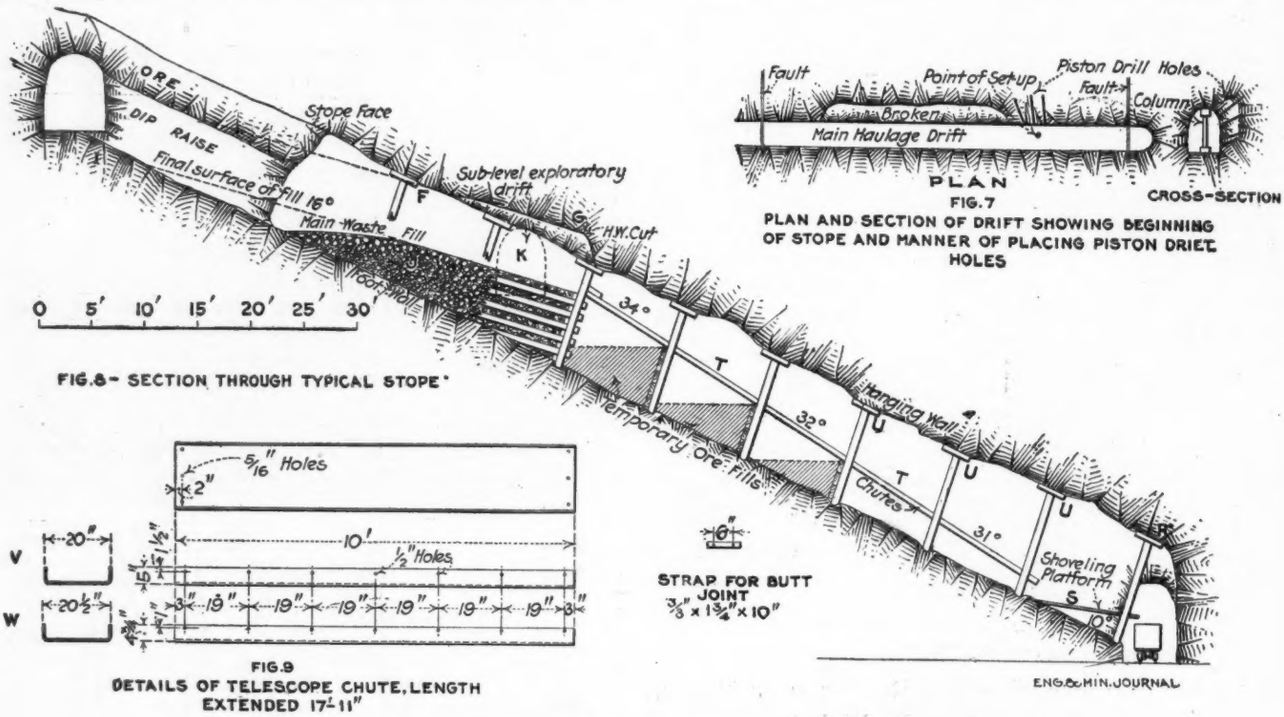


FIG. 8 — SECTION THROUGH TYPICAL STOPE

FIG. 9
DETAILS OF TELESCOPE CHUTE, LENGTH EXTENDED 17' 11"

FIG. 7
PLAN AND SECTION OF DRIFT SHOWING BEGINNING OF STOPE AND MANNER OF PLACING PISTON DRILL HOLES

Beginning of Stope, Stope Section and Details of Steel Chute

being set at a steeper angle than the foot wall, the 9-ft. 9-in. spacing of the stulls accommodates nicely the 10-ft. chute lengths; 40-penny nails, driven through the $\frac{5}{16}$-in. holes in the ends of each chute, hold the latter in place, and the straps shown in Fig. 9 are bolted, like fish plates, both inside and outside for greater solidity. A drop of 18 in. is allowed between the lower end of the fixed chute *T* and the platform *S*, Fig. 8. The two lower chutes are set up at an angle of 31° with the horizontal, the next two at 32°, and the fifth and last at 34 degrees.

As the difference between chute and foot wall increases, shoveling becomes more difficult. Moreover, when the face has advanced beyond the reach of the telescope chute, a considerable proportion of the broken ore, say 60% on a stoping length of 35 ft., must be brought to the fixed chute in wheelbarrows. The latter difficulty suggests the installation of shoveling platform and chutes in duplicate, but there is no saving on the stoping length assumed. The plan followed when the chute has reached a height of 4 work is undertaken beyond the lateral stoping limits. This generally takes the form of two sublevel drifts *K*, Fig. 8, one at each end of the stope, driven from a point a little above the middle. Such work furnishes material for the main waste fill, which is built up from the ends of the stope toward the dip raise until it encounters the central ore fill. The latter is then mucked out and a cut *FGH* made in the hanging wall about 3.5 ft. wide to provide head room for the dumping of wheelbarrows in the upper part of the stope. Holes, 12 to 14 in number, drilled with the stoper, suffice for the hanging-wall cut, and the waste produced fills the space previously occupied by the last temporary ore fill, the width of which is limited by that of the dip raise.

As soon as the dip raise holes into the next level, stoping is begun again, breaking toward the raise. Fig. 8 illustrates this last phase. It shows the stope face advanced about 25 ft. along what was previously dip raise, with 20 ft. still to be broken. The main waste fill is almost com-

pleted, its final surface being the dotted line *IJ*. Waste for this part of the fill may be obtained most cheaply from development on the upper level. The final surface, inclined at 16° with the horizontal, affords easy wheelbarrow grade from any part of the stope.

The aplite dikes which are often present in the oreshoot constitute a further source of waste. This material, where reasonably hard and unaltered, may be easily sorted from the broken ore, and used for permanent filling in place of the temporary ore fills.

Costs

In driving the main-haulage drifts an average advance of 2.8 ft. per machine shift is maintained. Seven- and eight-hole rounds are employed, using 23 to 30 sticks of du Pont blasting gelatin, depending on the hardness of the ground. Piston-machine men earn $3.50 per 8-hr. shift; timbermen and trackmen, $3.50; and trammers, $2.50. Muckers and trammers and most of the machinemen are Mexicans. Faces are mucked out on the night shift, affording a clean set-up. Tunnel sets are seldom needed. The cost per foot of drift or crosscut averages about $4.64, distributed as in Table I:

TABLE I. DRIFTING COST PER FOOT

Labor, breaking	$1.25
Labor, mucking and tramming	0.90
Labor, track and pipe	0.08
Labor, blacksmith	0.22
Explosive	0.80
Track (rails, ties, etc.)	0.30
Pipe and fittings (1¼ in.)	0.10
Candles and lubricating oil	0.09
Power and water	0.64
Drill repairs	0.05
Blacksmith coal and drill steel	0.06
Superintendence	0.15

The power charges of Tables I, II and III are figured as follows

Average charge against mine for power and water, Jan. 1, 1914 to Apr. 1, 1914, per day, $16.

Machine drills operated, daily average: Piston machines, drifting and stoping, 5; stopers, raising, 3; stopers, stoping, 3.

Charging power to stopers and piston machines in the ratio 2/3 to 1:

Five piston machines use $\frac{5 \times 1}{9}$ = 56% of the total + $8.96.

Three stopers raising use $\frac{3 \times \frac{2}{3}}{9}$ = 22% of total = $3.52.

Three stopers stoping use $\frac{3 \times \frac{2}{3}}{9}$ = 22% of total = $3.52.

Five piston machines at 2.8 ft. per machine will drive 14 ft. per shift. $8.96 ÷ 14 = $0.64 per ft.

Three stopers, raising at 2.5 ft. will drive 7.5 ft. per shift. $3.52 ÷ 7.5 = $0.47 per ft.

Three stopers, stoping at 17.5 tons, will break 52.5 tons per shift. $3.52 ÷ 52.5 = $0.07 per ton.

Assuming that 250 ft. of drifting is necessary for the development of the blocks *A*, *B* and *C*, aggregating 10,000 tons of ore of which 90% is recoverable, the development cost per ton for drifts and crosscuts only, comes to 15c. Adding to this 3c. per ton as the cost of crosscut raises and sublevel exploration work, 18c. per ton is obtained as a fair estimate of development costs on a block of this size.

Where the dip raise is not driven until the stope has been advanced over half the level interval, its cost properly falls under the head of extraction. In case the dip raise is driven through from one level to the next before stoping is begun, as is done in the more steeply dipping portions of the mine, its cost belongs to development. The cost per foot of long dip-raises averages only a little higher than that of drifts and crosscuts. Its distribution, however, as shown in Table II, varies in some respects from Table I. Stoping-machine miners earn $3 and $3.50, an average of about $3.20 per 8-hr. shift. Shovelers earn $2.25 and $2.50, an average of about $2.40. The advance per shift has already been given as 2.5 ft. Six- to nine-hole rounds are broken with from 20 to 28 sticks of powder, making the explosive cost about the same as in drifting. Steel chutes are less expensive than track and require about the same amount of labor in placing. Power per drill shift for Leyner Type A and Ingersoll-Rand MC 51 stopers is taken at two-thirds the piston-machine power cost. The principal difference is the shoveling item, covering the cost of mucking from the face into the chutes. This work cannot always be completed on the night shift even with forced ventilation. An average cost per foot for 100-ft. dip raises is about $5.40, distributed as follows:

TABLE II. DIP RAISE COST PER FOOT

Labor, breaking	$1.28
Labor, shoveling at the face	0.96
Labor, loading cars and tramming	0.93
Labor, steel chutes and pipe	0.08
Labor, blacksmith	0.24
Explosives	0.80
Chutes	0.17
Pipe and fittings (1¼ in. and 1 in.)	0.07
Candles and lubricating oil	0.12
Power and water	0.47
Drill repairs	0.05
Blacksmith coal and drill steel	0.06
Superintendence	0.17

Adding the cost of two 100-ft. dip raises to the development previously assumed increases the development cost on the 9000 tons recoverable by 12c. per ton, giving a total of 30c. The dip-raise cost is entirely offset on dips greater than 30°, by saving in extraction, since one round out of each cut in stoping is in effect a dip-raise round, and the work is carried on under better conditions.

Allowing for the initial round of each cut or lift in stope advance, the average break per machine shift is a piece of ground 3 ft. 3 in. by 7 ft. by 10 ft., or 17.5 tons. An average round is nine 3½-ft. holes with 30 sticks of powder. The average cost of extraction per ton for the typical stope illustrated in Fig. 8 is about $1.07, distributed as follows:

TABLE III. STOPING COSTS PER TON

Labor, breaking	$0.13
Labor, shoveling at face	0.26
Labor, loading cars and tramming	0.14
Labor, timbering	0.07
Labor, blacksmith	0.04
Explosive	0.14
Timber	0.09
Chutes	0.01
Pipe and fittings	0.00
Candles and lubricating oil	0.03
Power and water	0.07
Drill repairs	0.01
Blacksmith coal and drill steel	0.01
Superintendence	0.02

These tables cover breaking and tramming costs only. No account is taken of hoisting, sampling, assaying, office expense or depreciation. The item of superintendence covers only the foreman's wages.

Conical-Drum Hoist on the Marquette

The Nordberg company of Milwaukee is now erecting machinery at No. 3 shaft of the Breitung Hematite mine, Negaunee, Mich. The equipment includes one conical-drum and one cylindrical-drum hoist, a compressor and an electric-generator set. The conical-drum hoist is of the first-motion, corliss type, with 20x60-in. cylinders. The large diameter of the drum is 14 ft. and the small diameter 7 ft., the total length of face being 11 ft. 10 in. This type of hoist is uncommon on the Michigan iron ranges, and the installation is therefore of interest. The hoist will handle two Kimberley skips, each having a capacity of 7 tons of ore.

The Isabella Mine

A model mine, although one that is still to produce its first ton of ore, is the Isabella property of the Cascade Mining Co., in the Cascade district, five miles south of Negaunee, Mich. Ground was broken at the site of the shaft in September, 1912. Preparatory work has been in progress ever since, and the miners have still to penetrate the orebody. This should take place in August. The mine is being developed on the strength of discoveries made by exploration with the diamond drill. The company is controlled by the E. J. Longyear interests. F. P. Snyder, of Minneapolis, is president of the company, and O. B. Warren, of Hibbing, Minn., is general manager.

The mine is down to a depth of 750 ft., with a sublevel at the 600-ft. mark. Drifting to the ore is in progress. The shaft has five compartments and is 17 ft. 8 in. by 11 ft. inside. It is lined with steel and concrete from top to bottom. It is sunk in the diorite footwall all the way. The headframe will be of steel, 110 ft. high. The contract for its erection has been awarded to the American Bridge Co.

A pumping station, lined with steel and concrete, has been constructed at the 700-ft. level, below which is a 50-ft. sump. The station is equipped with two Prescott pumps with a combined capacity of 1200 gal. per min. Opposite the station, and across the shaft, is an ore pocket with a capacity of 50 tons. The mine is being provided with its permanent surface equipment, including an engine house and a boiler house, each of fireproof material; a hoisting plant and an additional air compressor have been ordered. The boilers are four in number, with room for a fifth. The stack is of concrete and is 130 ft. high. The force employed at present consists of 60 men.

Lilly Hoisting-Engine Controller

A controlling device for hoists, invented by W. J. Lilly, superintendent of machinery for the Anaconda company, has been thoroughly tried out at the Leonard mine and has been found so efficient that the company is planning to install it at all hoisting engines operated by the company, involving an expenditure of something like $75,000. The controller is a little machine standing only 26 in. high, requiring neither steam, air, water or other pressure for its operation; it has no pipes, valves, piston or cylinder and is absolutely positive in its operation. According to Mr. Lilly's statements, the machine will:

(1) Prevent the engine from running the cages into the sheaves at the headframe, or into the sump at the bottom of the shaft.

(2) Stop the engine in case the engineer fails to slow down at a safe distance from the top and bottom landings and continues to slow down until he stops at the landing in the proper manner.

(3) Control the engine, if on reaching the top or bottom landings with the cages the engineer pulls the throttle open for starting on the return trip without reversing.

(4) Sound an alarm for slowing down the engine when the cages are nearing the top and bottom landings.

(5) Ring an alarm when the engine begins to overspeed in hoisting or lowering.

(6) Stop the engine if the engineer does not heed this alarm and bring the engine to normal speed.

In general, the device will perform every operation that an engineer can perform in bringing the engine to a stop.

Steel Production in the United States

The Statistical Bureau of the American Iron & Steel Association has compiled and published its full statistics of the production of steel in the United States in 1913. The production was the largest ever reported, though it exceeded that of 1912 by a small quantity only, as shown below. The chief point noted is a further decrease in the make of bessemer or converter steel, and a large gain in open-hearth steel, chiefly in basic metal.

The steel production in 1913 by processes was as follows, in long tons:

	Acid		Basic		Total	
	Tons	%	Tons	%	Tons	%
Bessemer (convertes)	9,545,706	30.5	.....	.....	9,545,706	30.5
Openhearth	1,255,305	4.0	20,344,626	65.0	21,599,931	69.0
Crucible	121,226	0.4	.....	.....	121,226	0.4
Electric	30,180	0.1	.....	.....	30,180	0.1
Miscellaneous	3,831	....	.....	.....	3,831	....
Total	10,956,248	35.0	20,344,626	65.0	31,300,874	100.0

Of the bessemer or converter steel, 9,465,200 tons were turned out as ingots and 80,506 tons as direct castings. Of the openhearth ingots, 20,689,715 tons as ingots and 910,216 tons as direct castings. Of the crucible steel, 17,571 tons; of the electric steel, 9107 tons, and of the miscellaneous or special steels, 3244 tons were direct castings. Included in the basic openhearth steel are 2,210,718 tons produced by the duplex process, made from metal partly treated in bessemer converters and finally purified in openhearth furnaces. This is an increase of 772,064 tons, or 53.6%, over the previous year.

A comparative statement for two years is as follows, the figures being in long tons:

	1913	1914	Changes
Bessemer	10,327,901	9,545,706	D.782,195
Openhearth	20,780,723	21,599,931	I.819,208
Crucible	121,517	121,226	D. 291
Electric	18,309	30,180	I. 11,871
Miscellaneous	2,853	3,831	I. 978
Total	31,251,303	31,300,874	I. 49,571

Bessemer steel decreased by 7.5%, while open hearth increased by 3.9%. There was not much change in crucible and special steels, while electric steel increased by 64.8%. The total increase was 0.16% only. In 1912 the total production of steel in the United States exceeded that of pig iron by 1,524,366 tons; in 1913 the excess was 334,573 tons.

In 1913 the production of steel treated with ferrovanadium, ferrotitanium, nickel and other alloys was 714,357 tons, a decrease of 78,144 tons from 1912, but a large increase over any preceding year. Of this alloy steel, 625,430 tons were produced as ingots and 85,927 tons as direct castings. The total included 74,924 tons bessemer steel, 213,404 acid openhearth, 386,486 basic openhearth, 28,279 crucible and 11,264 tons electric and miscellaneous steel.

At the close of 1913 there were 30 plants equipped to make steel by the standard bessemer process and 80 by the Tropenas or other modifications of that process. There were 119 basic and 93 acid openhearth plants, 29 of them being equipped to make both acid and openhearth steel. There were 110 crucible steel plants and 19 electric plants.

A New Blast Furnace to Smelt Concentrates

By Ellis W. Honeyman*

SYNOPSIS—Description of a blast furnace built at the works of the Detroit Copper Mining Co. to smelt concentrates produced in the company's mill in the Morenci district, Arizona. The furnace is operated under low blast to prevent excessive production of flue dust.

The new 44x396-in. blast furnace erected by the Detroit Copper Mining Co., of Morenci, Ariz., is interesting as an example of a blast furnace designed to do what is customarily regarded as reverberatory work. The principal copper-bearing material smelted is the concentrates made in the company's mill, about two miles north of the smelting works. The old blast furnace, which had done practically all of the company's smelting for the last 12 years, was in a bad state of repair, and, moreover, in order to handle the tonnage, it was necessary to drive it faster than was advisable when running on so fine a charge.

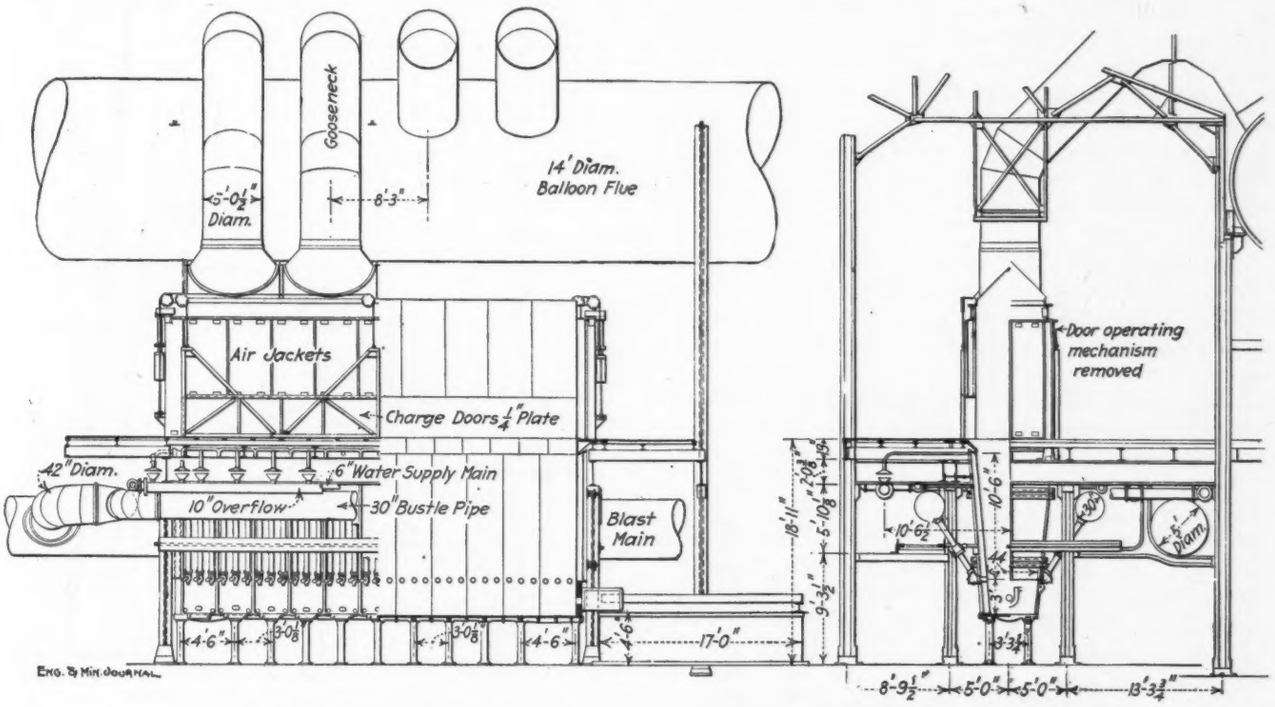
Smelting a Fine Charge with Low Blast and Slow Driving

The blast-furnace plant handles about 440 tons of total charge per day and the furnace was made unusually large for this tonnage for two reasons. First, it was desired to reduce the intensity of the blast in order to diminish the heavy production of dust incident to the smelting of a charge of fines in the blast furnace. Then, the necessity for fast driving of the old furnace in order to handle the tonnage had compelled the production of rather basic slags by use of barren limestone flux. With a furnace of ample capacity run slowly, more acid slags could be produced with a corresponding reduction in the tonnage of flux and at a considerable saving in the cost of mining and smelting this barren material. The new blast furnace is 44 in. wide at the tuyeres and is operated under a blast pressure of only about 14 oz. The furnace is 33 ft. long and is constructed of single-tier jackets, 11 being required for each side and two jackets for each end. The furnace superstructure is air-jacketed and has a gable top to prevent the lodgment of dust.

Cast-Steel Bottom Plates

The furnace bottom plates are made of cast steel, this material having been selected with a view of lessening the tendency to crack; the plates are strengthened by webbing, but are not water cooled. They rest on a double row of cast-iron columns. The furnace bottom is lined with chrome brick set on end on a 4½-in. layer of firebrick.

The furnace jackets are similar to those used in the Cananea furnaces, being 3 ft. wide and extending to the feed-floor plates. The water space of these jackets, however, is deeper than customary, being 6 in. The jackets have a batter of 13½ in. in a height of 13 ft. 6 in. The fire sheets are of ⅝-in. steel plate and the backs of ⅜-in. plate. Two 4x6x$\frac{7}{16}$-in. angles are attached to the back of each jacket as a reinforcement, the edge of the 6-in. legs being in contact with the fire



Detroit's New Blast Furnace for Smelting Concentrates

*Philomath, Ore.; formerly smelter superintendent, Detroit Copper Mining Co.

sheet. The end water jackets extend only to the tuyere line, below which is a cast-iron tap jacket containing a coil of pipe for water cooling.

The side jackets are held in place by jacks or turnbuckles attached to girders forming part of the furnace building. The lower pair of girders, shown in the accompanying elevation of the furnace, are built up of $\frac{5}{16}$-in. plates, 48 in. wide, 6x6x$\frac{3}{8}$-in. angles and $\frac{3}{8}$x15-in. cover plates. These girders are tied together across the ends by a pair of 5x3$\frac{1}{2}$x$\frac{3}{8}$-in. angles, bolted to the girders, and are readily removable, when it is desired to change the end jackets. The end jackets are held in place by two sets of binders made up of a pair of 8-in. I-beams; the end binders are connected by 1$\frac{1}{2}$-in. steel rods running the length of the furnaces; each rod is in three sections, adjustment being obtained by turnbuckles and by nuts at the ends.

The Detroit Tuyere

There are three 4$\frac{1}{2}$-in. tuyeres in each side jacket; the tuyere blocks are of cast steel, with long rivets extending through the jackets. Attached to the outer surface by means of stud bolts is a cast-steel collar, slotted to receive the bolts by which the tuyere is held in place. The tuyere is provided with a stuffing-box into which the 4$\frac{1}{2}$-in. blast pipe is thrust, the joint simply being packed with asbestos. The tuyere cap is attached at the bottom by a loose-fitting hinge, the faces of the cap and tuyere being finished. When in use they are held together to make an air-tight joint by a revolving finger which intercepts a wedge on the outer surface of the cap.

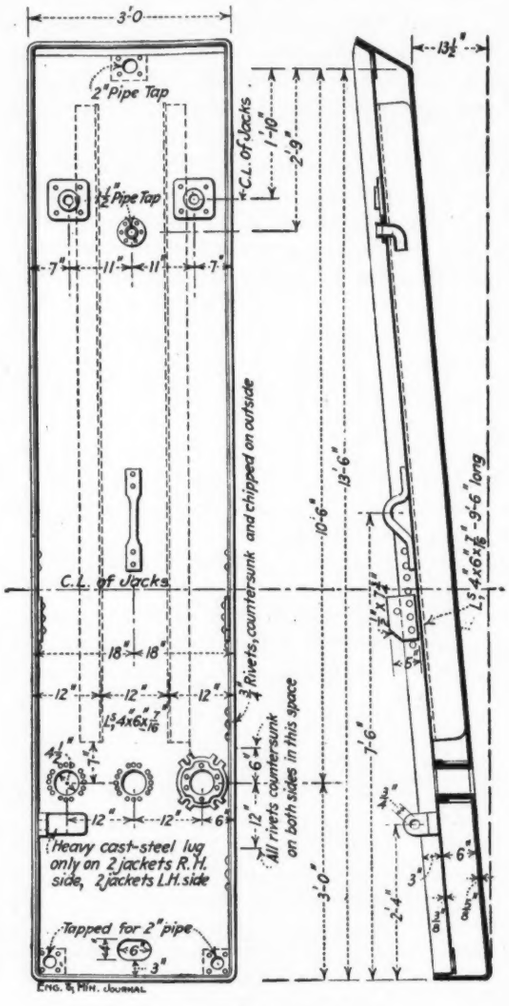
This finger principle is used on the tuyeres at several Southwestern smelting works, especially the Shannon and the Calumet & Arizona works, having originated, I understand, at the former plant. In the Shannon design, however, the cap revolves on the bolt of the finger, so that when a tuyere is slagged, the cap must slide over the face of solidified slag in the tuyere and then requires the assistance of a sledge hammer to open.

In my design, the cap drops completely out of the way the instant the finger is lifted. A raised ring was left on the inner surface of the cap to center it on the tuyere in case the hinge becomes very loose from wear. The construction of the cap might have been cheapened slightly by omitting this and having simply two flat surfaces to make the joint. As it stands, there are no expensive ball joints, springs, etc., and when the joint is made it is air-tight. A wooden plug is used in the cap for a peephole. An arrangement for holding a wooden wedge is provided on the bottom of the tuyere as a slag escape. The wedge burns out more readily than a plug in the event of a tuyere slagging, and the wedge is cheaper and easier to make.

The tuyere valve is an adaptation of the Copper Queen design and is on the order of a stop cock. It works easily and closes air-tight, and is more satisfactory than the usual gate valve. The tuyere and tuyere valve are attached by means of slotted flanges and bolts, so that by simply loosening the nuts, the tuyere and tuyere pipe can be removed to facilitate repairs to a leaky tuyere or to clear the way for a quick change of jackets.

The furnace spout is a steel water-jacketed trough; it is made of $\frac{1}{2}$-in. plate on the inside and $\frac{3}{8}$-in. plate on the outside, inclosing a 3-in. water space. Either end of the spout can be placed adjacent to the furnace breast; the blast is trapped by means of a mud dam in the outer end. The blast main is 60 in. in diameter and the bustle pipe 30 in., the connection to the main being 42 in. About 20,000 cu.ft. of free air is used per minute at 14-oz. pressure, supplied by a No. 9 Connersville blower driven by a Crossley gas engine.

The water-piping system for the jackets is all overhead and is reached from the big flat girder at the side of the furnace, this being used as a walkway. The overflows are close to the corresponding inlet valves and



Typical Side Jacket

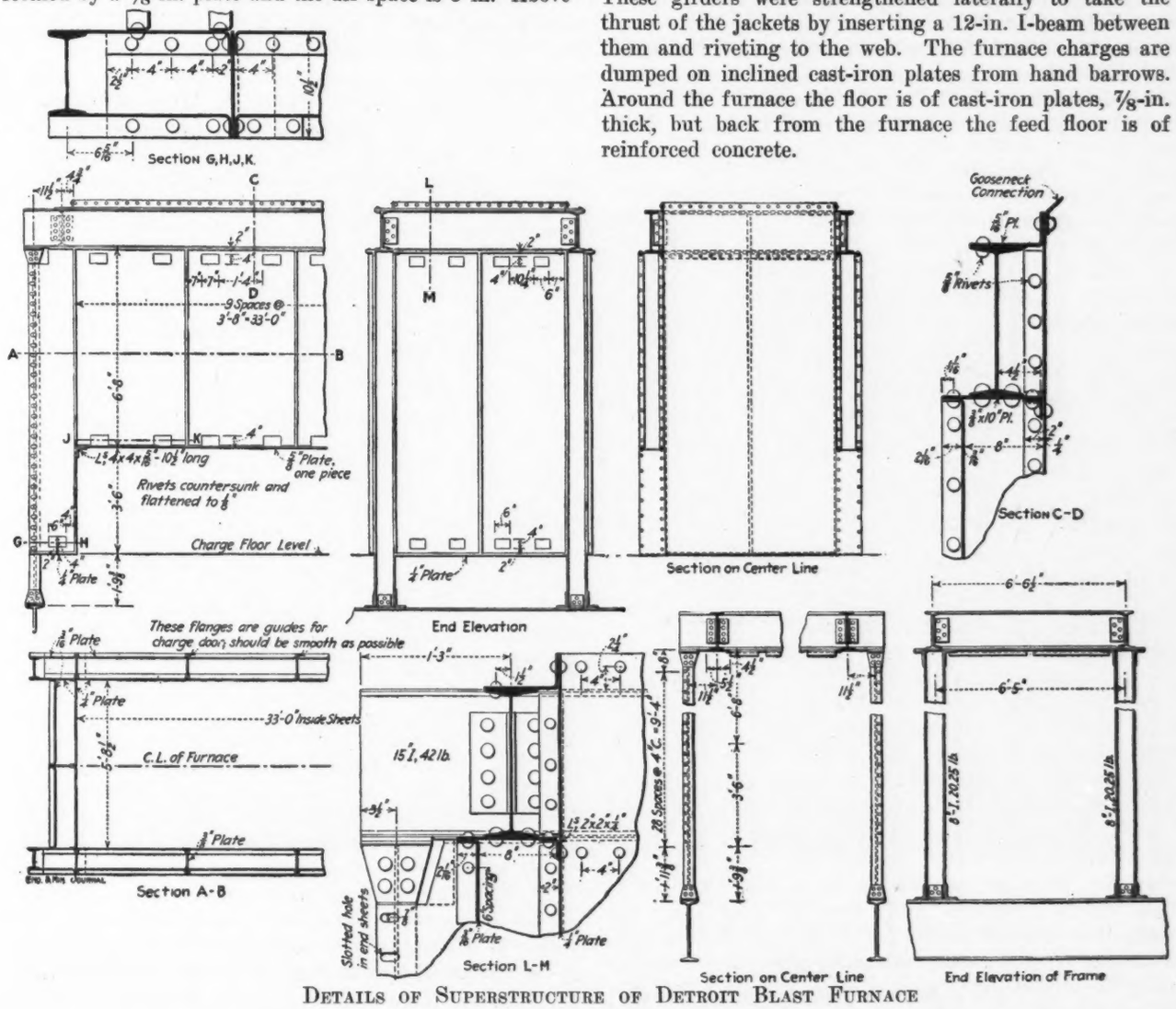
proper regulation of the water is easy to obtain. The funnels receiving the overflow water are protected from dust by shields of slightly larger diameter on the outlet pipes. The fresh-water supply main is 6in. and the waste main is 10 in. in diameter.

The furnace settler is of the usual cylindrical type, being 17 ft. in diameter and 4 ft. 6 in. high. It is made of $\frac{3}{4}$-in. plates. There is a 5x3x$\frac{1}{2}$-in. angle around the top of the settler shell and at the bottom a trough formed of a pair of angles with a series of plates; this is to carry away cooling water if it is found necessary to use a spray. On top of the settler there is a raised sheet-steel working platform. The settler bottom is lined with firebrick set on ends, except at the tap holes and under the furnace spout, where chrome brick was used. The

sides of the settler are lined with chrome brick, 9 in. long; a 6-in. space is left between the brick and the shell to permit expansion; this is filled with converter lining lightly tamped; only 10 courses of chrome brick are used on the side, after which five courses of firebrick are laid, the average matte level being below this line of division. The tapping blocks are made of copper, being cast in the converter plant. They are cast around a chrome block 5 in. thick and have a hole 2 in. in diameter.

The furnace superstructure is made up of a series of air jackets, the inner sheets being of 1/4-in. steel and the outer of $\frac{3}{16}$ in. The division wall of the jackets is formed by a 3/8-in. plate and the air space is 8 in. Above the charge opening and below the air jackets is a 5/8-in. plate running the entire length of the furnace and supported at each end on 4x4x$\frac{5}{16}$-in. angles. The air-jacketed superstructure is suspended from a frame resting on heavy girders beneath the feed floor. To avoid leaving a resting place for flue dust, the top of the superstructure was made in the form of a gable roof, from which lead four uptakes 5 ft. in diameter. This design was used as being easier to construct and maintain than a single large uptake. The uptakes lead to a steel balloon flue, 14 ft. in diameter, made of $\frac{5}{16}$-in. steel plate. A track is provided under the flue for a small car which receives the dust from a series of 6-in. pipes placed at 30-in. intervals. When the new furnace was erected, the old dust chamber No. 1 was torn out and a new one erected in its place, the plant meanwhile running on dust chamber No. 2. The latter and the new chamber are of hollow tile, with reinforced-concrete roof, and have wire baffles. The dust is removed by drag-chain conveyors.

The feed doors are of 1/4-in. plate braced by 2x2x1/4-in. and 3x3x$\frac{5}{16}$-in. angles, and are operated by hydraulic cylinders. The feed floor is supported at the sides of the furnace by girders formed of a pair of 24-in. I-beams with a cover plate on top to exclude flue dust. These girders were strengthened laterally to take the thrust of the jackets by inserting a 12-in. I-beam between them and riveting to the web. The furnace charges are dumped on inclined cast-iron plates from hand barrows. Around the furnace the floor is of cast-iron plates, 7/8-in. thick, but back from the furnace the feed floor is of reinforced concrete.



DETAILS OF SUPERSTRUCTURE OF DETROIT BLAST FURNACE

With the new blast furnace and enlarged dust chamber, there has been an improvement in the metallurgy and the cost of the installation was small compared with that of a complete reverberatory equipment. Moreover, the construction of a new blast furnace permitted the utilization of other equipment already at hand. The Detroit company uses Crossley gas engines in its power plant; to have utilized fully the power generated from the waste heat of a reverberatory furnace would have meant a much larger investment than was involved in the construction of this new blast furnace, which is serving its purpose admirably.

Buying and Selling Brass Scrap

Some of the tricks of scrap-metal buying are written up by W. H. Parry, of the National Meter Co., in *Metal Industry,* June, 1914, which show that mine salters have their counterparts in other lines.

Some few years ago there was bought one lot of 50,000 lb. of scrap copper, supposed to be high grade. What there was of it was fairly good. The stuff was delivered in casks of the hogshead variety and the tare was painted on each with white paint and in very large characters, with the evident intent of showing the customers that deception was not the seller's middle name. There being no immediate necessity for opening the casks, they were stored in a room outside of the foundry proper where the temperature in winter was all it was outside and then some.

After a few days in cold storage, some copper was needed by the melter, and he armed himself with a pinch bar, ax and hammer and such other light dental tools used in the profession. He was rather surprised to find that all the casks were open and had been for some time, as every cask in the lot had been burst to pieces from the frost. Every cask had been filled with water by the dealer. That is, there was some copper in them, but as water is a whole lot cheaper than even scrap copper, he figured to get away with the deal by being in collusion with somebody. He might have got away with it at that but for the melter, who reported the matter, more through a dislike for hewing ice to get at the copper than from any great desire to shine as a simon-pure, honest man.

The dealer was notified to take the mixture of casks, copper and ice away, and when called upon to explain the matter, blandly said that as most of the copper had been covered with insulation, it had been burned off and the wire had been placed in the casks hot. In order to avoid kindling them, they had sprinkled a little water on the copper to cool it off. On closer examination a liberal amount of oakum was found clinging to the top and bottom heads, and it was inferred that it was used to calk the heads so that they would hold a lot more than a mere sprinkling of water. It was estimated that at least one quarter of the net weight was *aqua pura.*

The next time this dealer supplied the company with copper he was instructed to deliver it in bales. He did, and they were some bales, averaging 1000 lb. to the bale, most of which was a copper-plated steel wire with a sprinkling of fine wire. In fact, the wire was so fine that the shrinkage in melting it in a Schwartz furnace was so great that Andy Carnegie would go broke using it if he paid more than 3c. per lb. for the stuff. You can imagine what happened when they tried to melt the copper-plated steel wire in a furnace that was gaited to melt brass only. As the melting point of steel is so much above that of brass the inevitable consequence was a lot of annealed steel wire, covered with the ashes copper, and well balled up at that. This happening almost drove the scrap dealer into the madhouse, as he claimed that he had sold the metal in good faith, having bought it as copper. It was found a little later that in his storage plant he had successfully operated an electric plating outfit, and it was suspected that his knowledge of how the wire became copper-plated had some depth.

Another company, a big purchaser of metals, had grown careless in its scrutiny of the means employed by the scrap dealers in delivering scrap copper to their foundry. They only woke up when the ale casks that were used as containers were found to have staves 3 in. thick and heads 5 in. thick. Since the average tare to be subtracted for this class of casks was about 80 lb., and as they actually weighed over 200 lb., it does not need anybody with an over-bright mind to figure a loss of 120 lb. to the cask. There were 50 of these casks in the lot, and 6000 lb. would not be a bad guess for the amount that the dealer had figured on getting away with. In this particular instance the dealer was caught with the goods on, and came very near wearing a striped suit for a few winters up the river.

In selling materials to this gentry, eternal watchfulness is as absolutely necessary as in buying from them. One of the biggest dealers in this part of the country is the owner of an immensely large St. Bernard dog weighing in the neighborhood of 150 lb. This animal is so well trained that if his boss is selling materials, he just loves to be weighed in with the load. He also has a strange antipathy to weighing out, but let his boss be the buyer, he then insists on being weighed as part of the empty truck, but never as part of the truck gear when the load leaves. This dog has earned his weight in diamonds is the belief of many good people in Brooklyn, N. Y., and the citizens of that town "point with pride" to this dog as an example of what can be accomplished if one will live in Brooklyn long enough to be trained properly.

The old dodge of weighing the driver plus a couple of well weighted feed bags has no place or standing here because of its being so well known. But when they ring in a heavy cast-iron plate about 3 in. thick that just fits in the driver's seat well covered with a couple of blankets it is about time to sit up and take notice. More particularly when several such plates are found on your premises after the junk dealer is through. You will then realize that there is a considerable difference in price between what he paid for the cast-iron plates and the residues he was hauling out from your place. In manipulating the weighing scales you will find that the dealers are not lacking in skill, and the stunts they can pull off on you are well worthy of close study.

In the employ of many dealers they have specially trained truck drivers. These drivers are so well versed in hewing close to the line of honesty that in driving on the scales when they are selling goods they can hit the center of the scales without any trouble. With equal ease when they are buying they can place one of the truck wheels so that half of its width, at least, is not on the scales. You may well believe that as sharpshooters these drivers ought to be able to hit the bull's eye 23 times out of a possible twenty.

The First Pig Iron to Be Manufactured with Anthracite Coal in the United States was smelted at Catasauqua, Penn., 75 years ago, on July 4, and an "Old Home Week" was held in that city that week to commemorate this event. The celebration program consisted of parades, band concerts, fireworks displays and sports. The first furnace to use successfully anthracite coal as fuel was erected by David Thomas, a Welshman, at Catasauqua, in 1840. Mr. Thomas, who had had a successful career as an iron maker in Wales, was induced to come to this country and to establish the furnace by companies holding large tracts of coal land in the Lehigh Valley. The original furnace was 42 ft. high and 12 ft. bosh and it was the first unit of what is today the Crane Iron Works, now a part of the Empire Steel & Iron Co. Mr. Thomas remained with the Crane Iron Works until 1852, when he turned over the management to his sons and established the Thomas Iron Co., at Hokendauqua, Penn., a short distance away.

The Chiksan Mines, Chosen--II

By Clarence L. Larson*

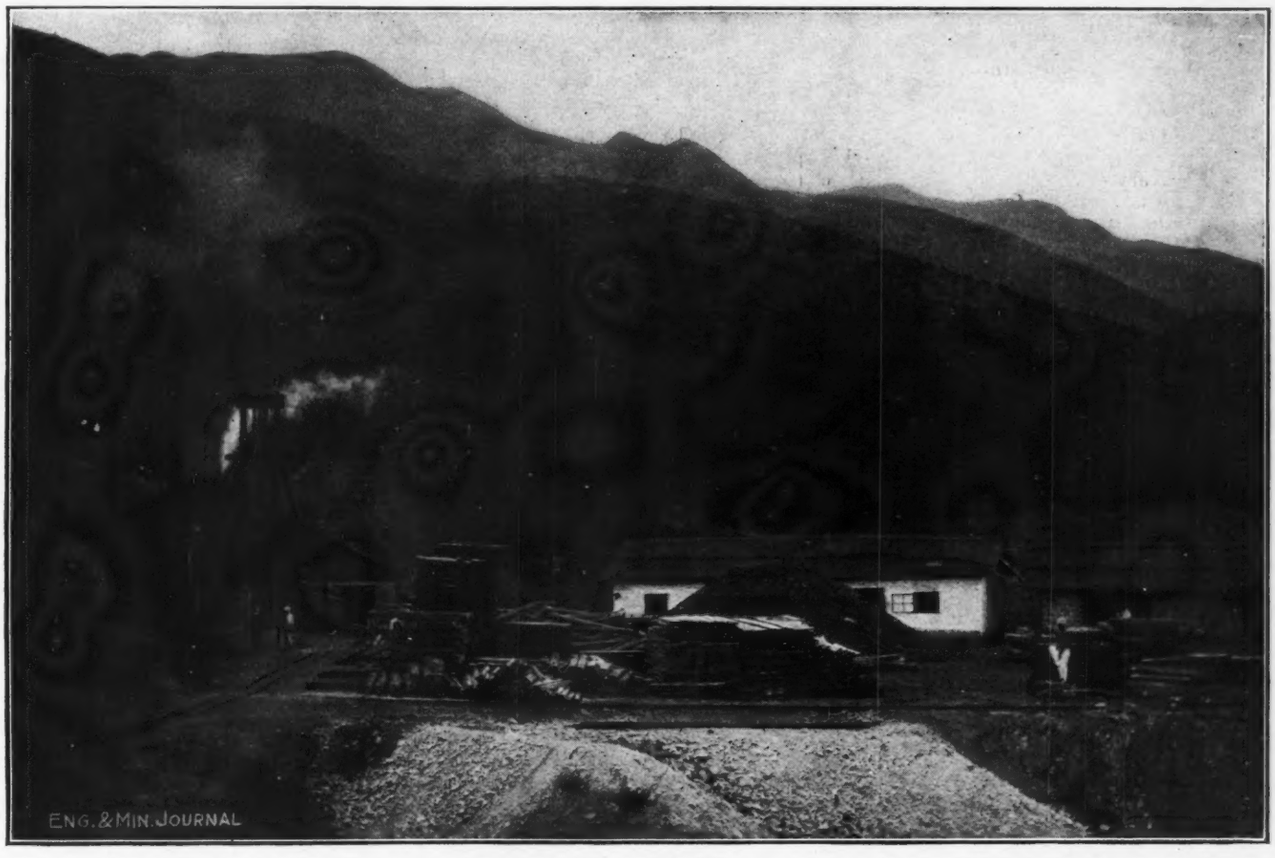
SYNOPSIS—The concession contains many quartz veins, most of them narrow and not reaching the surface. The main ledge can be traced 10,000 to 12,000 feet on the surface. Sajunkohl mine is the principal working on it. Tonkohl mine is on a parallel vein to the north. Chungtarrie is about a mile and a half farther north. The ore is gold in quartz with sometimes sulphides and galena.

The concession contains many quartz ledges, most of which are small, both in width and length. There are two or three outcrops of white and barren quartz, running from 30 to 50 ft. in width. Of the narrow ledges the large majority appear to be but gash veins having no considerable traceable extent. Two or three, however, may be traced hundreds of feet continuously across the country. They have been opened up in occasional spots by prospect holes.

The main ledge is traceable for 10,000 to 12,000 ft., and strikes northeast and southwest. Upon this ledge, and about midway between its traceable ends, is located Sajunkohl mine, the largest on the concession. At each end natives have worked down from the surface for 100 to 200 ft. Some company work has followed, but as yet Sajunkohl mine has been the only profitable venture on the largest ledge in the concession.

Practically all of the other known ledges lie to the north of this main vein, and the placer ground in the main valleys below. About 1000 ft. north of the main vein there is an almost parallel ledge on which Tonkohl mine is being worked. This is the second largest mine on the concession, and has produced a grade of ore considerably higher than that of Sajunkohl.

Chungtarrie is about a mile and a half northeast of Sajunkohl and Tonkohl mines, and is on a separate ledge. This mine has just passed the prospect stage, and now bids fair to hold its own as a small mine. Aside from these three mines all work is of a purely prospective nature.



The Tonkohl Mine, Chosen

Lens Formation of Ore

Ore occurs in lenses only, and these are usually indicated by but little value at the surface, if any at all. However, barren ledge quartz or ledge waste, together with proper ledge walls may readily be traced on the surface for long distances. The country is predominantly schist and granite, with pegmatite dikes, which seem to have had something to do with the ore deposition, since they occur in the neighborhood of the ore, sometimes serving as a smooth vein wall, and at other times knitting into the quartz ore on one wall, and again serving as both vein walls. Usually the pegmatite grades into granite.

Another kind of dike is present in the district. It consists of a brown, earthy material, ranging in width from stringers to 15 and 20 ft. It seems to have no particular

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relation to the ore deposits. These dikes usually occur in the granite. At one place in Sajunkohl mine such a dike served as hanging wall for a barren vein.

The lenses of ore are usually small and vary greatly in length from level to level. In Chungtarrie, No. 2 level opened up a 150-ft. back, while but 50 ft. was available on No. 1 level. This little mine contains many faults, but as yet the work has not progressed far enough to formulate any rule about it.

Sajunkohl mine has two shafts, but one of which is being operated at the present time. The abandoned shaft is approximately 450 ft. in depth. There are three drift levels and one adit opened up to the west. Above the No. 2 level the lens has been stoped out an average width of 5 ft., 200 ft. in height and about 350 ft. along the strike. On No. 3 level but 150 ft. of low-grade ore was encountered, although barren quartz continued on each side of this distance. Conditions did not warrant the continuance of sinking and hoisting operations in this extra shaft, and it was temporarily abandoned late in 1912, pending further investigation to be carried on from the main shaft. This lens has, however, provided the largest working area of any of the four yet developed. The ore is iron-stained quartz, barren of galena, and averaging $5 to $7 per ton. No pay values occurred in the surface showing of this lens.

The main shaft, located 280 ft. to the east, is now about 380 ft. deep on a 65° incline. Three levels have been opened to the east at 100-ft. intervals. The headings are now at 1200, 650 and 175 ft. from the shaft center. Three individual lenses have been opened up. These vary greatly in length at various altitudes, so only average dimensions will be given. The first lens shaded into ledge waste in No. 3 level, but ore is found 30 ft. above; thus its known dimensions to date are 4 ft. wide, 250 ft. high, and has a length along the strike of but 80 ft. This ore contains much sulphide, both of iron and lead, and has averaged $7 to $10 per ton.

The second lens is found about 80 ft. to the east of the first. It has been opened up by Nos. 1 and 2 levels, averages 90 ft. in length along the strike, has an average of 4 ft. width, and extends 180 ft. above No. 2 level. The ore was principally oxide above No. 1, with a wide streak of pyrite, but is essentially white quartz below No. 1, impregnated with fine points of galena. The ore has averaged $5 to $7 per ton, and as yet has not been cut by No. 3 level.

Between the second and third lenses lie 300 ft. of barren ledge waste. To date this has only been opened up by No. 1 level. In the stope above the level the ore averaged 8 ft. in width 200 ft. in length and extended up 80 ft., then pinching into barren ledge material. The ore from this stope is sulphide, containing both pyrite and galena and is rather schistose in appearance. These four lenses of Sajunkohl lack surface value, although three of them display outcrops of valueless quartz.

Tonkohl mine has been sustained on a single lens of ore. The shaft is 550 ft. deep on an 82° incline, and has six levels. The lens, averaging 4 ft. in width, had a small but high-grade surface showing, lengthened with depth, and extended down almost continuously for 350 ft. It had an average length of 200 ft. At depth the vein flattened to about 55° and the quartz pinched out. No. 6 level at a depth of 500 ft. shows a reversion toward a steeper dip, but as yet has developed no stoping ore, although an occasional stringer of quartz has been found containing $6 to $8 per ton. The ore from this lens was oxide for a depth of 100 ft., and from there turned into white quartz impregnated with galena points. The ledge has been prospected a horizontal distance of 1000 ft. beyond the limits of the ore, but no further lenses have been discovered. Remembering that the country has been much eroded, developments at greater depth should prove interesting and throw light on the genesis of the ore. A study of known conditions applied to the actual operating results indicates a district where pay lenses do not, as a rule, outcrop, or at least do not show pay value in the outcrops. The lenses are small and usually of low grade, about $9 per ton, and much barren ledge material lies between adjacent pay shoots.

Prospecting Methods

Native work is encouraged as much as possible and a great deal of it has been done. All such work is licensed through the company's offices, two arrangements being used. In one the natives are allowed to work a certain place, grinding and panning their own rock, paying the company a unit sum per miner employed per month. In the other arrangement the tributers work on a royalty basis, bringing their ore to the Yangdei mill for treatment and paying on a sliding scale of from 50 to 66% of the net assay value from which the company receives payment for milling, and its profit.

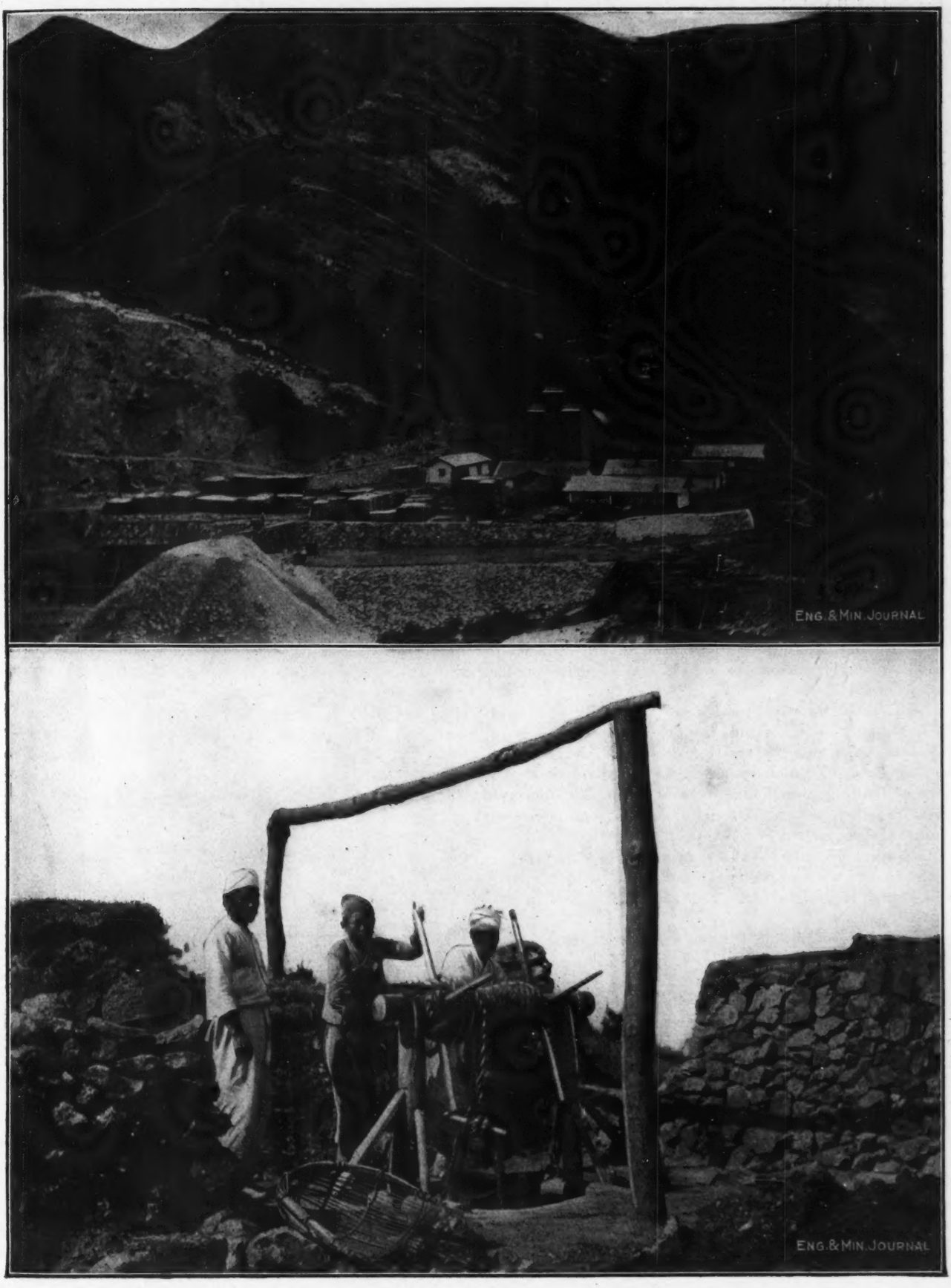
Native work is assisted by the company, according to the judgment of the superintendent of prospecting, in various ways, such as the providing of windlass and water bucket, or supplies such as explosives and steel on possibly an agreement of payment if ore is struck. The company reserves the right to take over any prospect at any time and then settles on the tributer a suitable bonus. Company prospecting is also being done, usually upon ledges that have previously been worked by the natives with some degree of success. Company work becomes necessary if any amount of water is to be handled.

Methods of Mining

A two-compartment shaft is the rule, the compartments being 4x4 ft. in the clear, one being utilized as a skipway and the other as a ladderway and for piping. The shaft is in most cases inclined to follow the ledge and from it levels are opened off at 100-ft. intervals, measuring along the dip. Regular sets of 8x8-in. sawed timber are placed at 5-ft. centers. Two-inch lagging is employed on all four sides usually, but if the walls are good the two ends only are lagged. The compartments are divided by a brattice of 1-in. boards. Thus timbered the cost per set of two wall plates two end plates, one divider, six posts, lagging, brattice boards and wedges, complete, is $12.83.

In opening from a level, long posts are used and a leveler sill is placed on each of the two end plates of the floor set, and on its divider. A crosscut from the skipway compartment is run directly into the hanging wall for 25 ft., from its end drifts are started at right angles to the crosscut and thus parallel to the vein. These drifts are deflected in regular curves so as to intercept the ledge at distances from 45 to 50 ft. from the center of the shaft. Drifting on the ledge continues.

Meanwhile shaft-sinking operations continue, and at a point 25 ft. below the station set a skip-pocket raise is started up into the hanging wall, breaking through into



THE SAJUNKOHL MINE AND A NATIVE PROSPECT HOIST

the end of the station crosscut. The pocket gate is installed at once and all excess waste in the level hoisted. The pocket is then enlarged at the top, and the station cut by enlarging the crosscut. The station is made to take timbers leaving 10x10 ft. in the clear; the floor is lagged with 2-in. boards. The track is next installed into the main drifts running over the long way of the ore pocket, and a grizzly of rails placed over the pocket. This method of balancing the operations allows continuous driving of level headings and shaft while cutting station and pocket, and minimizes the amount of rock to be shoveled into the skip for hoisting.

Headings may then be started at the points where the drifts struck the ledge, back toward and penetrating through into the shaft, thus completing the information concerning the block of ground above, and also serving as drain drifts direct to the station sump, or to the footwall side of the shaft, according as to whether the station is a pumping point or not.

Pumps are placed on alternate levels; a crosscut is run directly into the footwall of the shaft on the skip-way side, for 25 or 30 ft. Then sinking operations begin on the last 15 or 20 ft. of the crosscut and are carried to a depth of 10 to 12 ft. The sump is then enlarged on the sides. The pump may then be set on sills over the sump.

Drifts on the vein usually require timbers; crosscuts do not. Frequently the hanging wall is solid, allowing the use of a hitch. A cap set into this hitch, and a footwall post will then serve. However, if ore is present, a mud-sill becomes necessary, and usually it is advisable to utilize the hanging-wall post also, in order to avoid buckling of the three-piece set, as has occurred under heavily filled stopes.

In Tonkohl mine both walls are uniformly good and drifts usually demand timbers only where stoping is to take place. Stull caps are set in overhead hitches and stoping started. Small round timbers are laid upon the caps and filling placed directly over them. Seldom are posts required, other than those used at points where chutes are placed.

In Sajunkohl mine, however, in all stoping country, it is the rule to use two posts, cap and sill sets, 5 ft. apart, and round lagging above. Side lagging is seldom required.

When ore is encountered, raises are driven 100 ft. apart to the surface or to the next level, thus securing ventilation and openings for the introduction of filling waste. Usually alternate raises are two-compartment, one chute and other manway. From these raises overhand stoping operations begin, and as the first floor is removed along the strike, the tunnel sets are carefully knitted over with the round lagging, 4- to 6-in. timber. The stope is carried up in the conventional bench fashion for a distance of 5 to 15 ft., limited by the condition of the walls. During this period of mining, chutes are timbered up every 25 ft. along the strike, and ore is pulled in quantity just sufficient to leave good working room at the back. At the end of this period all the ore is transferred into the chutes, these being pulled just enough to allow more ore, thus avoiding the excessive wear on the timbers by falling rock in an open chute. Filling is then introduced from above and leveled up to within about 4 ft. of the back. The cycle of operations is then repeated. As the stope reaches the upper level, the floor pillar is removed in short sections, catching up track and sill-floor timbers on sills below, and thus obtaining almost perfect ore extraction.

Frequently stope hanging walls are heavy and tend to break off in large slabs, requiring stulls. In some cases these stulls are recovered in the filling process, in others abandoned. Throughout all mining operations, aside from the shaft and station timbering, native round timber is employed.

Mine Development

All development work is done by contract, and several headings are usually allotted to one man. Contracts are paid by the foot, the price including all labor (miners, muckers and timbermen), explosives, drill steel, candles and all miscellaneous supplies. Rapid work is encouraged by offering a bonus per foot for amounts in excess of those announced, each contractor being informed early in the month as to the bonuses to apply to his various headings.

The use of piston and stoping drills has begun but recently and hence definite results are not yet available. All of this paper will apply to hand work only. A general statement may be advanced at this time, however, that in drifting and raising work in hard ground, the machines attain footages about twice as great as would be attained by hand work. The labor cost is less but that of explosives considerably greater.

Shaft sinking is double-hand work, except for pop-holing. Three 8-hr. shifts of four miners per shift are employed. The contractor also provides a day and a night boss. Drilling usually continues through two shifts, thus hoisting the broken rock at night only. This is necessary as shafts have but single skipways and day is entirely occupied with ore and timber hoisting. A table of cost of sinking of the large mine shafts is given.

COST OF SHAFT SINKING

	Sajunkohl	Tonkohl
Labor	$10.59	$7.92
Explosives	1.16	1.99
Candles	0.66	0.67
Drill steel	1.05	1.68
Supplies	0.30	0.30
Timber	2.66	2.85
Framing sets	0.18	0.26
Hoisting	0.94	1.58
Total per foot	$17.54	$17.25
Footage	96½	51
Working depth, ft.	240-336	500-551

The footage per month ran from 11 to 25 in Sajunkohl shaft, and averaged 16½; from 11 to 14 in Tonkohl shaft; averaging 13.

Tunnel driving is also three-shift work, and four miners are used per shift, double-hand. Each shift drills and blasts its own holes. From 4 to 7 ft. of hole are drilled per man per shift. A table of costs follows:

COST OF TUNNEL DRIVING

	Sajunkohl	Tonkohl
Labor	$2.42	$1.97
Explosives	0.47	0.68
Candles	0.16	0.16
Drill steel	0.21	0.29
Supplies	0.04	0.05
Timber	0.15	0.15
Timber framing	0.01	0.02
Hoisting	0.42	0.26
Total per foot	$3.88	$3.58
Footage	844	1024

Monthly advances range from 30 ft. in hard ground, or in soft ground necessitating spiling, to 70 ft. in good country. The record to date is 89 ft. The drifts are made about 5x7 ft. in the clear. In drifting work lower per-foot costs are attainable by operating but two 10-hr.

shifts daily, but at a sacrifice of speed. Hence in all workings where speed is essential, three shifts is the rule.

Raising is two-shift work, the shift being ten hours. Each shift drills and blasts its own holes. Raise men drill 4 to 8 ft. of hole per man per shift. Stulls set in wall hitches are usually sufficient for timbering. In main raises through stopes this timber is usually removed with the upward progress of the stopes and full set timber installed. Raises are usually run small, say 4x6 ft. A table of costs is given.

COST OF RAISING

	Sajunkohl	Tonkohl
Labor	$1.19	$1.43
Explosives	0.38	0.79
Candles	0.10	0.18
Drill steel	0.10	0.27
Supplies	0.03	0.03
Timber	0.17	0.28
Timber framing	0.01	0.03
Hoisting	0.09	0.19
Total per foot	$2.07	$3.20
Footage	460	530

KOREAN MINERS IN A STOPE

Monthly advances run from 20 ft. in some extremely hard ground in Tonkohl, to 70 ft. in easy ground in Sajunkohl.

Winze driving is done by three-shift work; four miners per shift of 8 hr. Windlass hoisting of the broken rock is necessary. Twenty-five to 30 ft. per month is attained in dry ground such as is usual in Tonkohl mine Sajunkohl winzes usually tap considerable water, requiring the use of pumps, and occasioning slow progress from 60 ft. down. The recent air-drill installation allows of quick raise work and makes it neither necessary or efficient to drive winzes beyond the first easy stage of 50 or 60 ft. Costs of winze work is shown in the table.

DETAILED COST OF WINZES

	Sajunkohl	Tonkohl
Labor	$4.74	$3.71
Explosives	0.66	0.78
Candles	0.32	0.27
Drill steel	0.53	0.59
Supplies	0.19	0.09
Timber framing	0.04	0.03
Timber	0.65	0.30
Hoisting	0.62	0.53
Total per foot	$7.75	$6.30
Footage	310	246

Winzes have two compartments, in the clear 4x4 ft. for hoisting, and 2½x4 ft. for manway. In Tonkohl mine stull timbers set in hitches are usually sufficient, with occasional hanging wall plates. On the foot wall a bucket track is constructed of 2x4-in. by 10-ft. timber. Sajunkohl winzes usually have square sets of round timbers.

Crosscuts are run small, about 4x6 ft., and are all two-shift work of two men each. No timbering is required. Costs of crosscutting is shown in the accompanying table.

COST OF CROSSCUTTING

	Sajunkohl	Tonkohl
Labor	$1.72	$2.34
Explosives	0.57	1.15
Candles	0.11	0.22
Drill steel	0.25	0.39
Supplies	0.02	0.04
Hoisting	0.20	0.54
Total per foot	$2.87	$4.68
Footage	142	134

Sajunkohl work has usually been in soft schist, while the Tonkohl work has been in granite and hard schist. Chinese miners are excellent in drifts, crosscuts or raises in dry ground, but will not work in wet places or in winzes or shafts underground. In drift work they are more efficient than the Koreans. As muckers and trammers they completely outclass the Korean workman. The latter do good ork in wet ground and seem very hardy, only occasionally succumbing to malarial attacks or water-bitten feet. They work with no foot or leg protection other than straw sandals; rubber coats made from the wrappings of explosives are usually provided for the wet places.

STOPING

Practically all stoping work for the past year has been done by contract, the price paid being based on the square foot of wall area exposed by the stoping operations. The contract rate includes all labor of mining, mucking, timbering, tramming and filling, and the cost of all explosives, drill steel, candles and miscellaneous supplies. Prices are determined from study of the pertinent conditions such as the characteristics of the ground as to drilling and breaking, length of tram, timber requirements, filling conditions, etc.

Stopes are measured the last day of each month, and the exposed wall areas calculated by the use of a planimeter. Prices have ranged from $1.30 to $1.60 per square foot. Miners in contract stope work make from $0.26 to $0.30 per day. Two 10-hr. shifts are employed and blasting allowed twice on each shift.

TABLE OF STOPING COSTS

	Sajunkohl	Tonkohl
Breaking	$0.35	$0.38
Mucking and tramming	0.08	0.11
Timbering	0.01	0.01
Drill steel	0.05	0.06
Supplies	0.03	0.02
Explosives	0.09	0.11
Candles	0.04	0.06
Timber	0.09	0.08
Timber framing	0.01	0.01
Hoisting	0.19	0.15
Total per ton	$0.94	$0.99
Tonnage	17,845	10,502
Duty per man in stoping	0.57	0.50

Contract Systems

The main argument in favor of contract work is that an unwritten law seems to have been established throughout Korea, calling a miner's day's work the drilling of 4 ft. of hole, regardless of ground conditions. Thus day's-pay work in either stoping or development will average, per man per day, about 4 ft. ¼ in. of hole. Each contractor usually has several working places, employs his own day and night bosses, and is required to be on shift every day. The method employed by different contractors in the division of their money is interesting and pertinent. The money due each heading, after proper subtraction of the costs of all supplies, is issued in an envelope to the contractor. From such an envelope, the muckers and trammers are first paid at a rate of 20c. per shift, the tool boys at 17½c. and the timbermen at from 30 to 40c. The remainder is divided among the miners, bosses and the contractor, according to the shifts worked, the contractor himself being credited with a shift per day for each day in the month. Should the average shift wage be more than ordinary day's pay wages, that is, 25c., the miners make the contractor a present. The contractor shares in each of his headings. In the case of large stopes, the contractor usually takes a percentage for his share after the muckers, toolboys and timbermen are paid, usually 10%, and divides the rest among his miners.

Some development contractors also follow this method of percentage subtraction. In but one known case has a contractor paid his men on a straight day's wage basis. This one was an especially capable man and had a number of places among which were two difficult winzes. He appropriated part of his stope money to help out on the winzes; whether the fact was known or not to his stope miners is a question.

Contract wages vary from 26 to 30c. in stope work and in dry headings, and in wet and difficult places, 25 to 35c. High footages attaining bonus prices raise miners wages to 35 to 45c. per day.

Shifts and Wages at Calumet & Hecla*

It is found impracticable in the Copper Country to put in three 8-hr. shifts with a 24-hr. day, inasmuch as the time occupied in handling the men and supplies would cut seriously into the hoisting capacity, while the amount of broken material would be increased, so that the balance of operations would be disturbed. Two shifts are, therefore, worked each day, and the interval between is used for handling supplies, timber and men, and for giving the workings opportunity to clear of smoke after blasting.

Under the old system of work, the trammers in the mine, whether on night or day shift, each worked six shifts per week. The miners worked only five night shifts, or five and one-half day shifts; the day-shift miners came up at noon on Saturday and would not go to work again until Monday night; while the night-shift men who came up Saturday morning would not go to work until Monday morning. This figured but 23 shifts of actual work per month; nevertheless the men were paid for 26 shifts. About Jan. 1, 1913, however, the system was changed at the Calumet & Hecla mine and its subsidiaries, and while the miners were allowed a shift for Saturday, coming up at noon, the total number of shifts for which they were paid in a month was only 24. The rate of pay, however, was raised so that they got as much money as when they were paid for 26 shifts. Of course, with the contract men this change in the method of payment made no particular difference.

Under the old system the amount of time actually put in at work by the miners varied largely with the depth of the mine. In some properties it may have been as much as 8½ hr., but in the Calumet & Hecla it probably was not much over 8 hr. Under the present system the time worked is probably about half an hour less than under the old. The men are now allowed only a half an hour for lunch, whereas in the old system they were allowed a full hour. They are underground at present a full hour less than they were formerly. The changing of the shifts is partly on company time and partly on the time of the men.

Mr. MacNaughton presented a statement of average earnings of the underground men. At the Calumet & Hecla and subsidiary mines, July 1 to Dec. 31, 1912, the miners on stoping earned on an average $3.05 per shift; for drift stoping they earned $3.30; for drifting, $3.19; for sinking, $3.51; the general average was $3.11.

The average tramming wage at all the mines was $2.91 per shift. The average combined mining and tramming earning was $2.94 per shift. Since the miners were paid for 26 shifts, while working only 24, the general average of all kinds of mining, distributed over the 24 shifts actually worked, would be $3.37 instead of $3.11.

Similarly, Jan. 1 to June 30, 1913, operating under the new system, the average earning for stoping operations at the Calumet & Hecla and subsidiary mines was $3.39; the average for drift stoping was $4.07, the average for drifting was $3.63; the average for sinking was $3.57; the average for all this mining was $3.48. During the same period the tramming average at all the mines was $2.79, and the average underground wage, that is for mining and tramming, was $3.16.

*From testimony given by Manager James MacNaughton before the Congressional Committee investigating the recent mine strike.

Bill Validating Phosphate Locations

Washington Correspondence

Senator Smoot, of Utah, and Representative French, of Wyoming, have simultaneously introduced in the two houses of Congress a bill intended to validate deposits of phosphate rock heretofore made in good faith under the placer-mining laws of the United States. The bill provides, among other things:

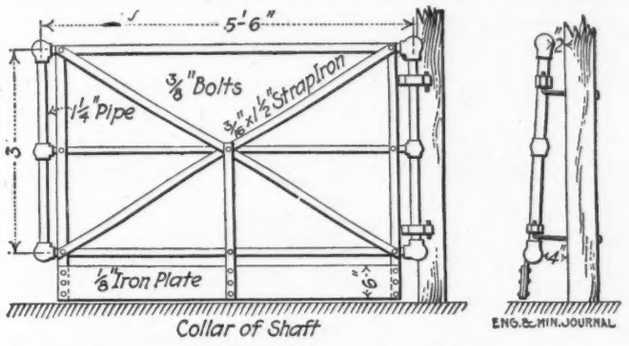
That where public lands supposed to contain deposits of phosphate rock have heretofore been located in good faith under the placer mining laws of the United States, such locations shall be valid and may be perfected under the provisions of said placer mining laws, and such locations shall give title and possession to such deposits. This Act shall apply to such locations heretofore patented: Provided, That this Act shall not apply to any location made subsequent to the withdrawal of such lands from location, nor shall it apply to lands included in an adverse or conflicting lode location unless such adverse or conflicting location is abandoned.

Details of Practical Mining

Swinging Shaft Gate of Iron

By W. H. Jobe*

A Verona Mining Co. shaft gate, reproduced in my annual report for 1912-13, is shown herewith. It consists of a frame of pipe and iron fence fittings braced with



Shaft Gate of Pipe and Strap Iron, Hung to Swing Shut by Gravity

strap iron. The gate is hung at a slight inclination, so as to swing shut of its own weight. An iron plate, ⅛x6 in., is fastened to straps from the gate at the bottom and serves as a "toe board."

The Danger of Primers

The practice of making up a supply of primers long before they are to be used is one that should be discouraged (*du Pont Magazine,* July, 1914). Although it is often convenient to have them made up before beginning loading, this is not so safe as to make them up at the time, and there have been many misfires reported on account of the primers having been kept too long. The cause of these misfires is not fully known, but it is probably due to the nitroglycerin, which is an oil, soaking into the fuse, dissolving and thinning part of the asphalt waterproofing, so that it runs into the powder core and results in extinguishing the fire when it arrives at that point in the fuse.

While rules and regulations for the handling of explosives, expressly forbid storing or shipping dynamite and caps together, yet primers, which are dynamite and caps put together in the very most dangerous combination possible are frequently allowed to be stored and carried around without due precaution.

Dynamite by itself, when set on fire, generally burns up without exploding and does no harm except to drive away everybody near-by with its objectionable and noxious fumes; but when dynamite is primed, it burns only a short time and then explodes; there is no uncertainty about that.

All that can be said in favor of making up primers ahead of time is that it is convenient to have them at hand for loading. Misfires are exceedingly inconvenient and misfires are apt to occur when primers and caps and fuse are kept for any length of time before loading. That primers of any kind are infinitely more dangerous than dynamite and detonators kept separate, no one will deny.

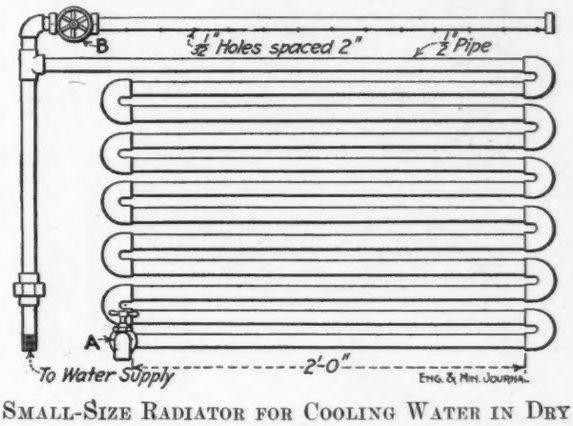
[Unquestionably primers are exceedingly dangerous things, and the careless way in which they are sometimes handled is outrageous. In general, the principle is correct, that dynamite and caps be kept apart until the last possible moment. Nevertheless, it is coming to be pretty well recognized among the better-managed mining companies that it is safer to have one or more experts in the mine making up primers than to intrust this delicate job to every common-or-garden miner. This, of course, necessitates making up the primers in quantity ahead of time and transporting them as such to the working place. The danger of accident in transportation is, of course, increased, but we believe that the danger of misfires, which is probably the greatest hazard in blasting, is appreciably decreased by having the primers all properly made.—Editor.]

*Inspector of mines for Iron County, Crystal Falls, Mich.

Cooler for Drinking Water

By E. W. Durfee*

For those living in arid regions, where a supply of ice is not always available, the apparatus herein described will be found satisfactory for supplying cool drinking water. One has been in use at the Alvarado mine for



Small-Size Radiator for Cooling Water in Dry Climates

the last two summers and has been found superior in every way to the *olla,* so commonly used throughout the southwestern United States. It is more efficient as a cooler, is perfectly sanitary and does not require the attention for filling and cleansing that is necessary with the other device.

Its efficiency, of course, depends upon the amount of humidity in the atmosphere, but for average conditions in Arizona the difference betweeen the temperatures of the wet and dry thermometers in summer is about 30°, and sometimes runs as high as 40°.

*Congress Junction, Ariz.

The accompanying sketch shows the construction, the whole being made up of ½-in. pipe and fittings. The pipes and return bends should be wrapped with thin cloth and placed in a shaded open place, where the prevailing winds will cause the maximum evaporation. The drip from the upper pipe should be regulated by means of the valve *B* to just the amount necessary to keep the pipes below wet. As the cool water is drawn from valve *A* it can readily be seen from the sketch that the pipes are kept filled from the water supply.

With an apparatus the size shown, about ten glasses of cool water can be drawn at one time, after which it will take about 15 min. to cool another supply to the minimum temperature it will attain.

Sectional Concrete Shaft Lining

A new and ingenious method of shaft lining, described in detail by Marcel Gillieaux, in the 1914 number of *Annales des Mines de Belgique,* is noted briefly in *Coal Age,* June 13, 1914.

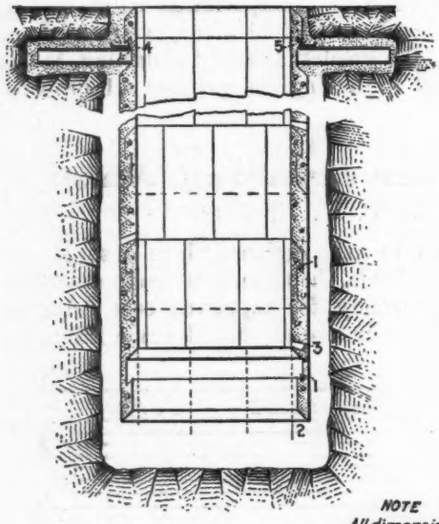


FIG. 1

FIG. 2

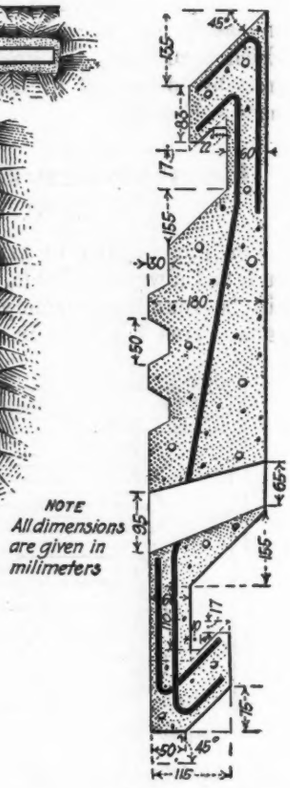


FIG. 3

A SUSPENDED REINFORCED-CONCRETE SHAFT LINING

It is applied to circular shafts and consists of panels of reinforced concrete keyed together both horizontally and vertically and capable of being suspended one from another by hooks or goosenecks cast at top and bottom of the blocks. The shape and proportions of the blocks are evident from the illustrations. Fig. 1 shows a lining in a shaft, supported by bearers in concrete. The plan, Fig. 2, illustrates the vertical jointing. The dimensions of Fig. 3 are in millimeters. The opening at 3, Fig. 1, serves the double purpose of allowing the blocks and lining to be centered by iron bars to the shaft wall and of affording an opening for running in cement to fill between the lining and the rock.

This appears to be the only concrete lining for a circular shaft which can be carried on down as sinking progresses.

Liquid Rheostat for Hoist Control

For the Brier Hill electric hoist of the Penn Iron Mining Co., Michigan, an automatic controller was first installed. It required so much attention and was so noisy that it was replaced with the liquid rheostat illustrated here (*Bull.* A. I. M. E., February, 1914).

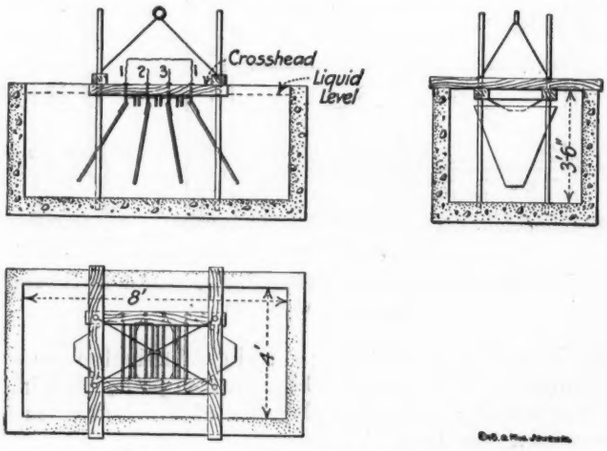


FIG. 1. CONSTRUCTION OF RHEOSTAT

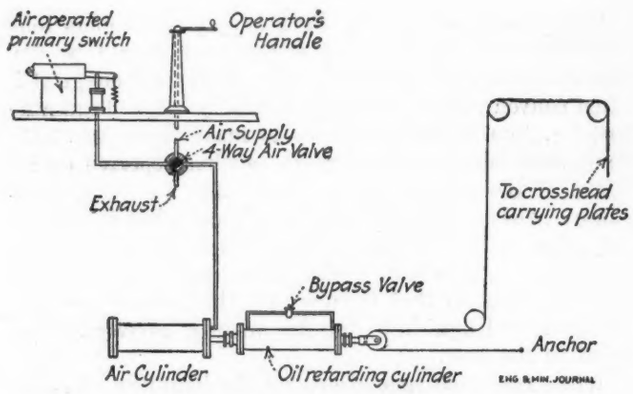


FIG. 2. OPERATING MECHANISM OF CONTROLLER

The tank is built of concrete, Figs. 1 and 4, open on top and kept nearly full of a weak solution of sodium carbonate. A timber crosshead suspended above the tank and four iron plates are attached to its lower side, as shown. The plates are connected to the three secondary leads from the motor. The crosshead is raised and lowered by a rope connection to the hoist room. The plates are inverted trapezoids, the shortest side being down, they are also set to flare from each other so that the lower edges are farther apart. As the plates descend, the resistance between them decreases rapidly. The fact that they are inclined, also serves to stir up the solution somewhat. In each of the three spaces between the large plates are two

smaller plates set much closer together, electrically connected to the larger plates and adjusted for height so that they enter the water just as the large plates become completely submerged. By adjusting the distance between

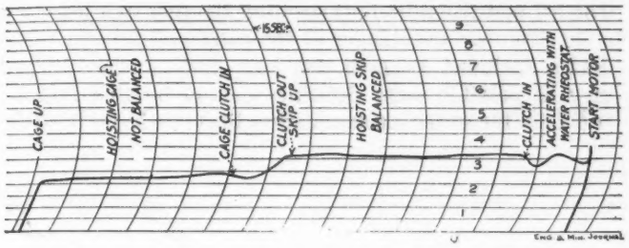


FIG. 3. HOISTING CURVE FOR SKIP AND CAGE

these small plates, the amount of slip of the motor when pulling full load at full speed can be varied.

The system of controlling the submergence of the plates is shown in Fig. 2. A four-way valve having only two

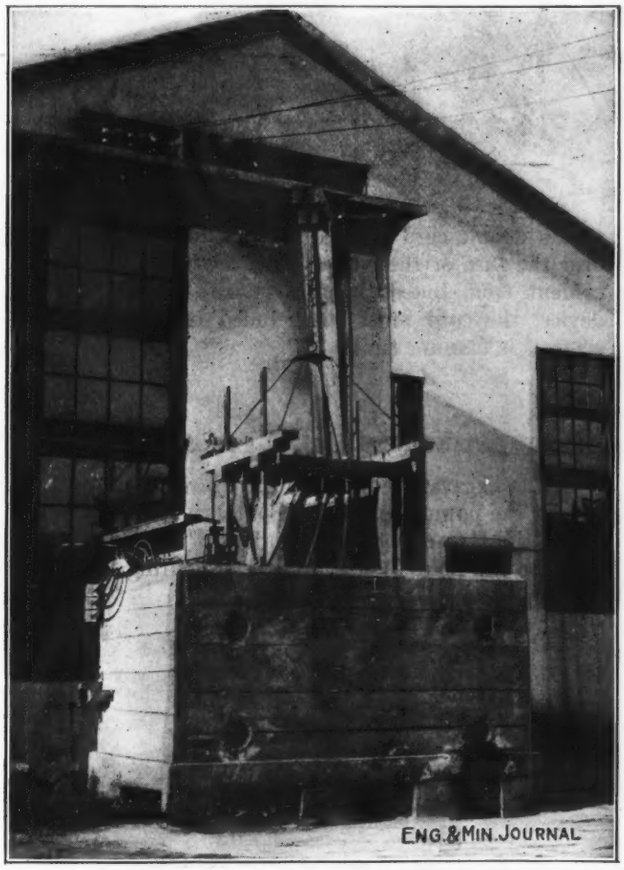


FIG. 4. THE RHEOSTAT CONTROLLER OUTSIDE THE HOIST-HOUSE

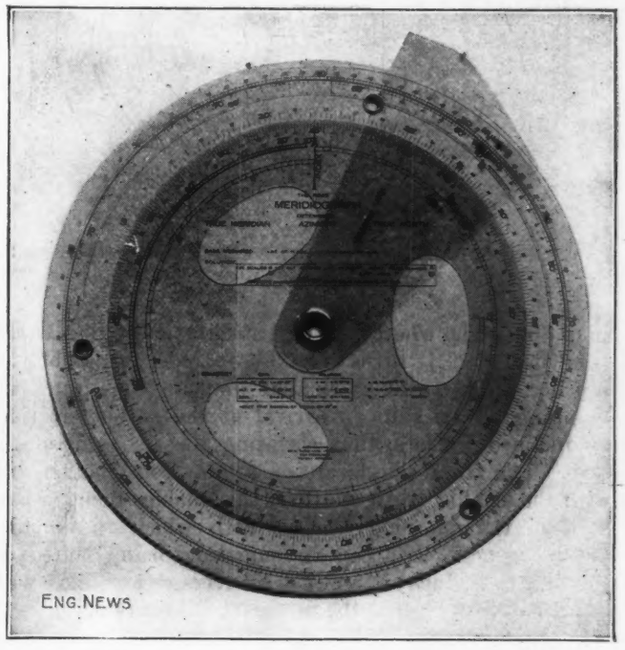
positions, "on" and "off," is manipulated by the hoisting engineer. In the "on" position, that shown in the drawing, a supply of compressed air is admitted to a small cylinder, which closes the primary switch. At the same time, live air from the air cylinders connected to the rheostat is allowed to exhaust to the atmosphere. The release of pressure in this cylinder permits the crosshead and plates to sink in the water by their own weight, but the rate of sinking is controlled by the amount of opening in the bypass valve connecting the two sides of the oil-filled cylinder, which is connected in tandem with the air cylinder.

Near the end of the trip, the engineer throws the controller valve to the "off" position; the air exhausts from the primary switch cylinder, so that the switch opens and live air is admitted to the rheostat cylinder, which raises the plates.

In Fig. 3 is shown a typical hoisting curve. It is customary to bring the motor and transmission machinery up to speed before clutching in the drum. This operation consumed 20 sec., and the power demand was remarkably uniform. As further explanation of the curve, it should be stated that the hoist has two drums, one for the cage, the other for the skip, the latter balanced with a counterweight. The horizontal line of the skip hoist represents almost perfect counterbalancing.

Simplification of Solar Determination of Azimuth

A recently developed device called the "Meridiograph" is designed to simplify calculation so as to make the determination of astronomical north by the solar method



THE MERIDIOGRAPH

a relatively easy matter without the use of auxiliary attachments on the transit. It was described in *Engineering News,* Feb. 26, 1914.

The field work consists of taking an observation with an ordinary transit on the center of the sun and determining its altitude and its bearing in relation to some other line. The latitude of the place is determined from a map and the declination of the sun is obtained from an ephemeris. These data are then combined by means of the meridiograph to give the true azimuth of the sun at the time of observation, and thus the true azimuth of the line used as a reference course in the field. The instrument resembles in general a circular slide rule. It consists of two graduated disks rotating relatively to each other, of a guide arm and of a transparent cov-

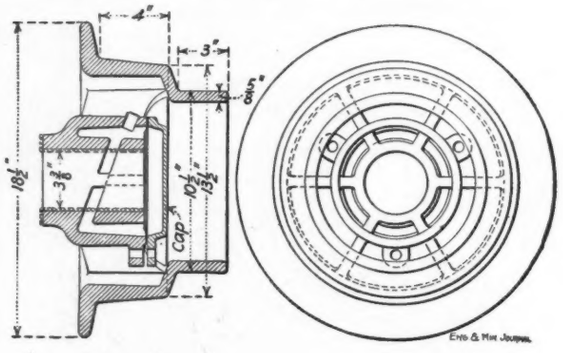
ering. In use, two settings and a simple addition only are required. An accuracy of from 1′ to 2′ is claimed, depending on whether the sun is near the horizcn or not.

While direct solar observation has always been available as a method of determining north, it involved troublesome calculations, using spherical trigonometry. It is in the elimination of these calculations that the meridiograph becomes useful. The device is manufactured and sold by its inventor, Louis Ross of 268 Market St., San Francisco, Calif.

Rear Skip-Wheel of Two Diameters

By T. Swift*

The accompanying drawing shows a rear wheel used by Witherbee, Sherman & Co., Inc., of Mineville, N. Y., for skips of 68 cu.ft. capacity, operating on a track dipping 30°. The wheel is of cast steel made by the Bethlehem Steel Co. It turns on a 3⅜-in. axle, in a babbitted bearing. The tread of smaller diameter facilitates the dumping of the skip on arrival at the pocket; it rides on inclined timbers, thus elevating the rear end of the skip. The front wheels are of similar construction, but with the smaller tread omitted; this enables them to pass between the dumping timbers with which the smaller tread engages. The cap is removable, being bolted on through three lugs; it and the oil recesses are filled with heavy car oil to insure the necessary lubrication.



Wheel for Rear of Skip with Two Treads for Dumping

A Wrought Candle-Sconce

The drawing shows a candle-sconce used in the Harold mine on the Mesabi. It is of an unusually substantial pattern, being worked out by the blacksmith. The stick can be driven into a post securely by a rap on the end, this being protected by bending over it a lug of the saucer. The saucer itself catches all drippings.

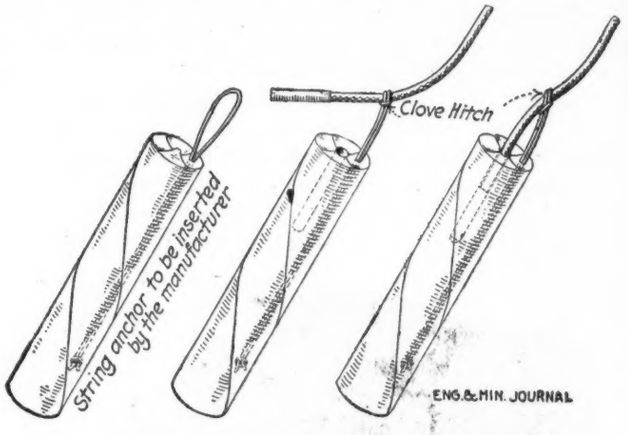
Sconce Consisting of Saucer, Stick and Socket

*Mining engineer, Mineville, N. Y.

Modified Priming Device

By William W. Jones*

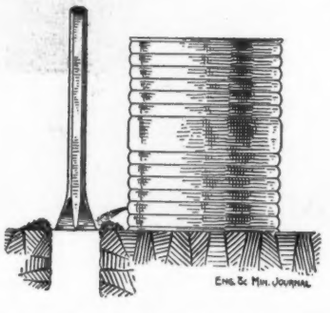
I described in the Journal, Feb. 21, 1914, a device which I had patented for attaching the fuse to a primer so as to eliminate the danger of the cap's pulling out. This device included a small wood or fiber anchor. There may be possibly some difficulty caused by this tamping and I am therefore recommending that this be omitted and that a double cord be used instead, to take a clove hitch over the fuse or the wires. The method of doing this is evident from the drawing. As with the first described device, the cord must be included in the powder stick when it is manufactured.



Manner of Constructing Primer

An Automatic Chuck Tender

In the excavation work of the Hardaway Contracting Co. for the power dam of the Southern Aluminium Co. at Badin, N. C., an ingenious method of supplying drilling water to the holes is employed. The drilling is done with piston machines on tripods, operated by one man each. The holes are, of course, down holes and about 3 in. from the collar of each there is set a powder can with a small hole near the bottom. The stream of water issuing from this falls into the drilled hole and takes care of itself, while the operator cranks his machine. The rock in process of excavation is a greenstone, amphibolite.



Powder Can Arranged to Supply Water to a Down Hole

*State mine inspector, 148 Jay St., Albany, N. Y.

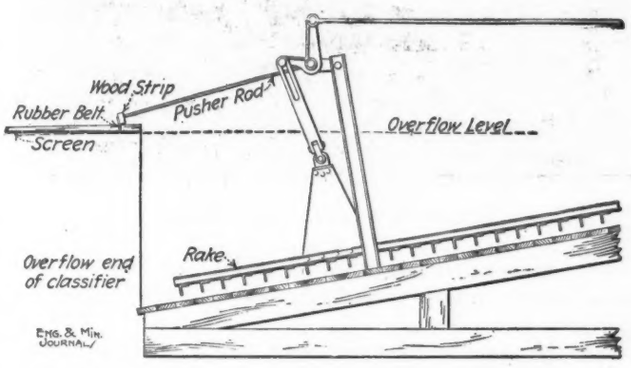
Details of Milling and Smelting

Self-Cleaning Classifier Screen

Abundance of wood chips in the mill pulp at the Hollinger mill, Timmins, Ont., led to the arrangement of a device to screen them out automatically and at the same time keep the screen clean. The device is shown in the accompanying drawing.

At the slime-discharge end of the Dorr classifiers, a screen of the proper aperture is placed the entire width of the overflow, so that all of it has to pass the screen. All chips and floating pieces are caught on the screen and prevented from passing on with the pulp.

To keep the screen clean, a reciprocating pusher is



OVERFLOW SCREEN CLEANER FOR DORR CLASSIFIERS

made by tacking a strip of rubber belting to a wood strip the same width as the slime-overflow opening. A rod of iron is fastened to the middle of this strip at right angles to it, and the other end of the rod is fixed to the lower bracket of the Dorr classifier. This imparts a back and forth movement which sweeps the chips to the rear of the screen where they can fall out of reach of the pulp.

The ends of the wood strip which carries the belting, slide on a strip which is inclined slightly, so that at the end of the back stroke it raises slightly, resulting in a motion similar to that of the rakes in the Dorr classifier itself. In this way chips and rubbish are removed from the pulp without any particular care on the part of the mill men.

Elevators and Centrifugal Pump

Operators in different localities have been divided as to their preference for belt-and-bucket elevators and centrifugal pumps for raising pulp. In America the preference has been for the elevator, while in Africa more appreciation seems to be given to the centrifugal pump. Both have advantages. As to power requirements, the elevator seems to have the best of it, since it is balanced, and power is required only for a straight lift of the actual material to be raised, aside from the little friction in the pulleys. The centrifugal pump is also balanced, but has pipe friction to overcome and lacks in mechanical efficiency. On the other hand, it is cleaner and more easily handled, except when repairs are to be made.

Oxyacetylene Welding

Oxyacetylene welding is now practiced at many mines and metallurgical establishments for making repairs to equipment which, in many cases, it would require months to replace in any other way. When oxyacetylene ap-

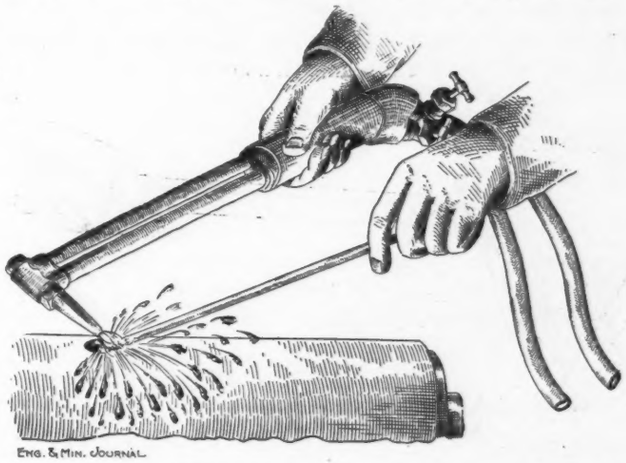


FIG. 1. PROPER POSITION OF WELDING TORCH FOR FILLING IN HOLES

paratus first arrive at the works, the books of instruction regarding its use are carefully studied by those who are going to operate the apparatus. As time goes on, however, the books of instruction are lost and new operators take the place of old ones, so that the instructions orig-

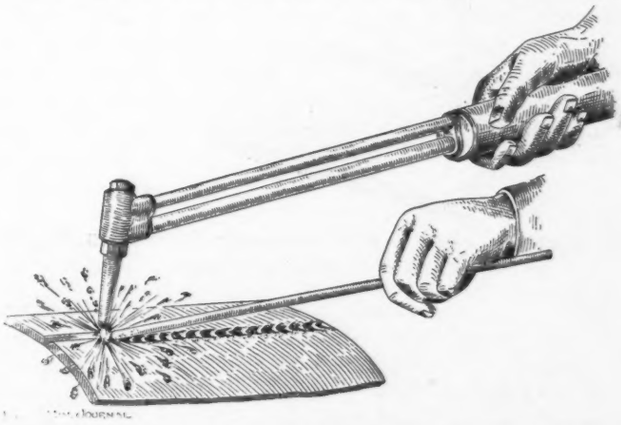


FIG. 2. PROPER METHOD OF HOLDING WELDING ROD

inally given are lost and the welding is not so efficiently done by the later operators. To insure the best work in oxyacetylene welding, the instructions should be carefully followed and for this reason we are reproducing, with the permission of the Vulcan Process Co., of

Minneapolis and Cincinnati, some engravings from its book of instructions, illustrating correct methods of holding the welding rod and manipulating the torch.

Fig. 1 shows the correct position of the welding torch

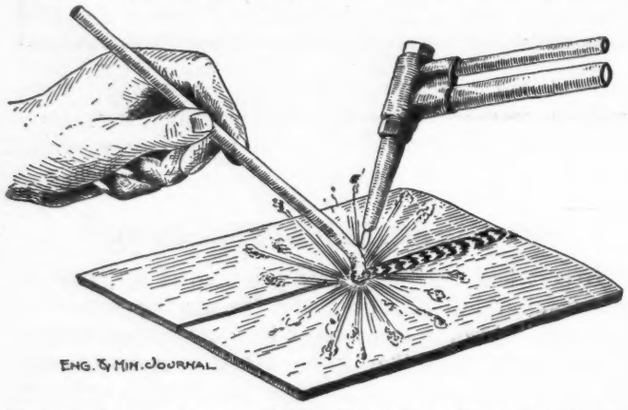


FIG. 3. METAL ADDED MUST NOT FALL DROP BY DROP INTO THE WELD

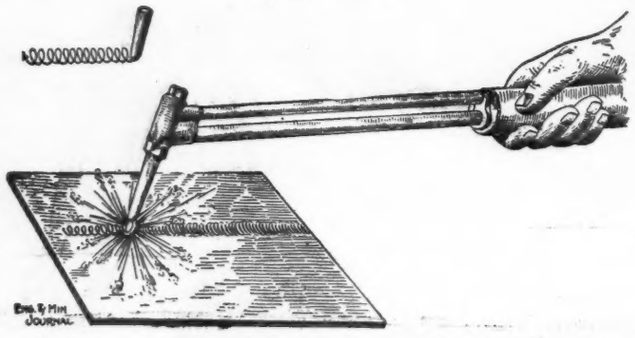


FIG. 4. CIRCULAR MOVEMENT OF WELDING TORCH

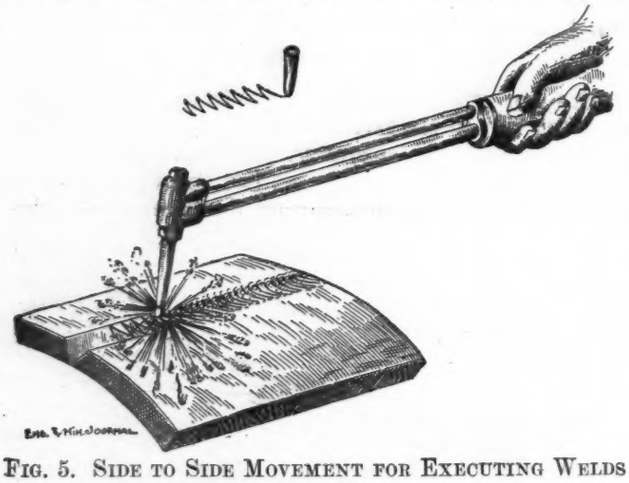


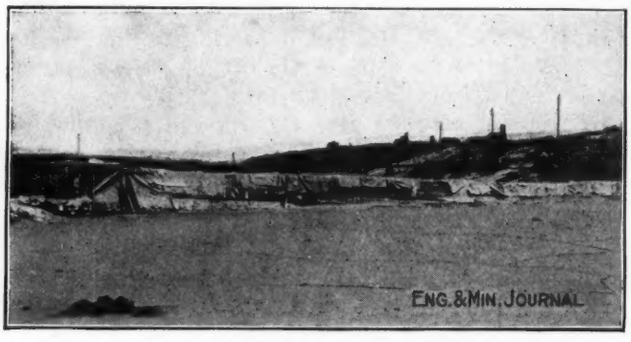
FIG. 5. SIDE TO SIDE MOVEMENT FOR EXECUTING WELDS OF GREATER THICKNESS

for filling in holes; and in Fig. 2 is given the proper method of holding the welding rod. The added metal must not fall drop by drop into the weld, but must form a pool of molten metal that can unite with the molten sides of the opening, as shown in Fig. 3. Fig. 4 illustrates the circular movement of the welding torch during the execution of the weld, while Fig. 5 shows the side-to-side movement used for welds of greater thickness. The low-pressure torch, based on the principle of the injector, has largely been superseded by the positive- or medium-pressure torch in which both the acetylene and oxygen are under an appreciable pressure.

Slime Dam of Cyanide Boxes

In cyanide plants of the older type, it was usual to impound slimes residues in dams made of sand or of the partly dried slime itself. With plants of the newer type, however, which treat an all-slime product, the residues are such that it is hardly possible to use them to make a dam. The material is too fine and slimy to have the requisite strength, and is likely to break away and run when the wet residues come in contact with it.

This problem of slimes retention is an aggravated one at the mill of the Nipissing Mining Co., due to the fact that the product is so fine that it all goes through a 200-mesh screen, and also that the residues must be prevented from infringing upon adjoining property. It has been solved cheaply by utilizing empty cyanide cases for the basis of the dam.

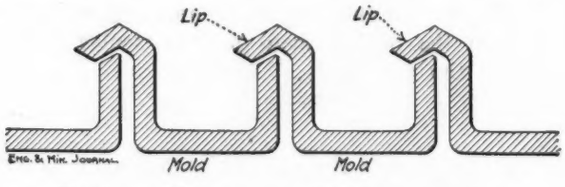


SLIME DAM OF CYANIDE BOXES

All the cyanide cases are saved, and when they are required for use, they are taken to the dump, filled with slimes, and a line of them, placed close together, strung across at the desired point. The weight of the slimes anchors the boxes securely, and as they are protected by the case, there can be no washing away. The drying slimes soon calk up the interstices between the boxes, and a tight, solid dam results. The method has proved entirely satisfactory.

Overlapping Bullion Molds

Bullion melting at the Buffalo mill, Cobalt, is done in reverberatory furnaces, and there is a problem in passing the stream of molten metal from one mold to another without spilling. To minimize this loss, molds are made with a lip which overhangs into the next mold, so that any molten silver may be deflected into one mold or the other without spilling. A number of these molds are placed on a long truck which can be run under and past the tapping spout. When one truck of molds is full, the stream can be dammed momentarily while another is pushed into place. The accompanying drawing shows the overhanging lip of the molds.

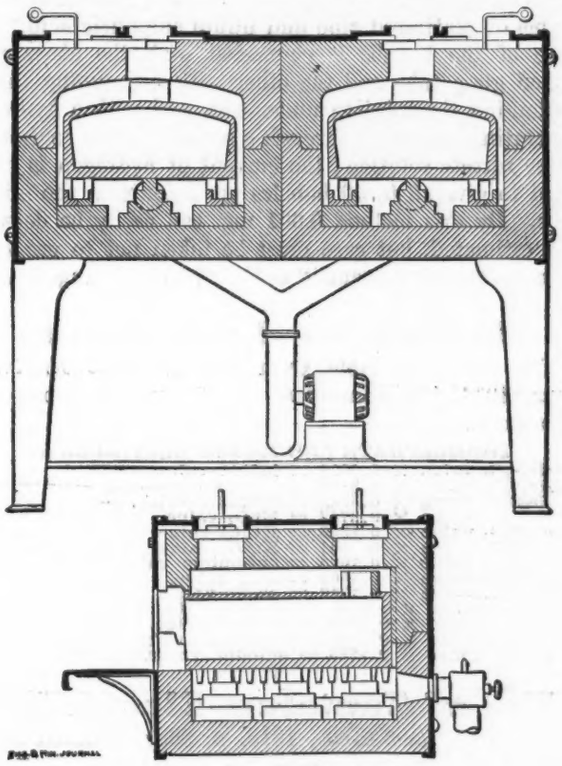


BULLION MOLD WITH OVERHANGING LIP

The Assayer and Chemist

Case Assay Furnace

A new assay furnace has been patented (U. S. pat. 1,076,346) by W. W. Case, of Denver, Colo., which has for its object the elimination of the inconvenience which accompanies the use of solid fuels like coke, coal or charcoal, and also the inefficiencies of liquid fuels like gasoline, oil, etc., the difficulties in the latter case being principally due to unequal heating. The new furnace is oil fired, two or more muffles being heated by the burner and fan. Proper heat distribution is obtained by splitting the flame of the burner by angular pedestals, which also serve to support the muffles. The furnace itself is composed of two parts, of fireclay, and is easily taken apart for cleaning or renewing.



CASE ASSAY FURNACE

A flue system is arranged so that an oxidizing current through the muffles may be commanded at any time for feathering cupels.

Picric Acid in Iodometry

Picric acid is recommended as a standard substance for iodometry by A. Sander (*Zeit. angew. Chem.*, p. 192, 1914). It is not hygroscopic and gives a very sharp end-point without the addition of an indicator. The following equations illustrate the interactions involved:

$$6C_6H_2(NO_2)_3OH\,(\text{or } 6HCl, \text{ etc.}) + 5KI + KIO_3 = 6C_6H_2(NO_2)_3OK\,(\text{or } 6KCl, \text{ etc.}) + 3I_2 + 3H_2O.$$

Iodine is estimated by thiosulphate solution standardized by the picric acid $\left(\frac{N}{24} \text{ or } \frac{N}{100}\right)$. The iodide-iodate solution should contain 40 grams of potassium iodide and 10 grams of iodate per liter. It is stable, but becomes yellow on prolonged exposure to light; sodium thiosulphate is then added until the color disappears. Many colored solutions of acids—and bases—may be analyzed iodometrically if starch solution be added toward the end of the titration of the iodine. An illustration of this is the determination of sulphurous acid in the presence of thiosulphate and sulphuric acid.

The total sulphurous acid and thiosulphate are determined by titration with iodine, and then the sulphuric acid produced by oxidation of the sulphurous acid is determined by adding excess of iodide-iodate (see preceding abstract), and titrating the liberated iodine with sodium thiosulphate, thus:

$$3H_2SO_4 + KIO_3 + 5KI = 3K_2SO_4 + 3I_2 + 3H_2O.$$

A mixture of sulphurous and sulphuric acids may be analyzed in a similar manner, the former being oxidized by iodine, and the total sulphuric acid then present determined with iodide-iodate solution. Bisulphates behave in an analogous manner.

The Iodate Method for Copper

BY W. W. BROSTROM*

The potassium-iodate method for the accurate determination of copper presents many features that recommend it to the chemist, but a lack of practicable methods of manipulation have caused it to be neglected.

During the last two years the Calumet & Arizona Mining Co.'s laboratory has experimented extensively with this method and has finally developed a method of manipulation that gives satisfactory results, comparing favorable with the electrolytic or iodide methods. On careful work a determination can be made in 40 min., and where accuracy of $\frac{1}{10}\%$ is sufficient, in even 20 min. However, for close work directions should be carefully followed.

As a matter of comparison, the following results will give an idea of its accuracy. The assays were made by four different chemists, all in different laboratories:

Iodide	Electrolytic	Iodate	Umpire (Ledoux)
8.57	8.54	8.53	8.55
9.50	9.52	9.48	9.49
8.55	8.55	8.52	8.50
9.05	9.08	9.01	9.03
9.22	9.27	9.20	9.25
9.84	9.91	9.84	9.84
Av. 9.122	9.145	9.097	9.110

The following solutions are required:

Potassium iodate, chemically pure, 14.73 grams per liter (0.0025 Cu.).
Potassium sulphocyanate, chemically pure, 40 grams per liter.
Sodium sulphite, chemically pure, 200 grams per liter.
Chloroform or carbon tetrachloride.

*Chief chemist, Calumet & Arizona Mining Co., Warren, Ariz.

If the ore does not contain more than 12% copper, take one gram of ore; if higher, take only ½ gram. Place in a 250-c.c. Erlenmeyer flask. Decompose with appropriate acids, adding 3 or 4 c.c. of sulphuric acid. Evaporate to fumes. Add about 50 c.c. cold water, when cool and ammonia until just alkaline. Then add 5 c.c. strong hydrochloric acid and bring to a boil on the hot plate. Reduce the copper by adding 10 c.c. sodium sulphite solution. When the assay is white, add 5 c.c. of potassium-sulphocyanate solution to precipitate the copper. Boil for one minute and remove from the hot plate. If the assay turns red at this point, it indicates too much acid. By adding ammonia carefully, this can be destroyed. However, it does not affect the copper.

Filter while hot on an S. & S. filter No. 589, white band is best, fitted closely in the funnel. Fill the filter nearly full and allow the solution to run through. Considerable of the precipitate will probably pass through the filter. Filter this again. The second filtrate will be absolutely clear. Finally filter the rest of the flask, washing the flask thoroughly with hot water. When the last washings have passed through the filter, remove the filtrate and replace with a clean beaker. As the precipitate has a tendency to creep, it should now be carefully washed down to the center of the filter paper with a small amount of water. Allow this wash to run through, finally passing the filtrate again through the filter. This catches all the precipitate that has crept to the top of the filter. Finally wash thoroughly with hot water four times, directing the stream only at the top of the filter. The solution and wash water filter rapidly and it takes but a few minutes to go through the foregoing operations.

In the original flask place 30 c.c. strong hydrochloric acid, 20 c.c. water and 4 c.c. chloroform or carbon tetrachloride; the latter is preferable. Remove the filter from the funnel with a circular motion to remove any adhering precipitate from the funnel.

Place the filter paper with the precipitate in a wide-mouthed copper flask of about 250 c.c. capacity and add the contents of the Erlenmeyer flask. Shake the flask a minute, then gradually add the standard iodate and shake vigorously. An intense red color will be produced, which increases until one-half of the copper has been titrated, and then decreases until the reaction is finished. After each addition of the iodate, the bottle is vigorously agitated until finally one drop of the iodate will discharge the last remaining color. A little practice will be required to shake the flask skillfully without a stopper. About two minutes will be required to titrate an assay.

If one gram of ore was used, divide the cubic centimeters by 4 to get the percentage of copper.

To avoid loss of the assay in case of over-titration, a solution of KSCN can be made that will just balance the iodate. By titrating back with this solution until the red color again appears and deducting the KSCN reading from the KIO_3 reading, the true value may be found. By titrating a few cubic centimeters of the stock KSCN solution with iodate, an approximate solution of the value of the iodate can be made up and finally adjusted.

Once standardized, both iodate and sulphocyanate solutions will remain unchanged until used up. The latter on long standing forms a "mother," which should be filtered off before using, as its presence affects the results. This solution may be used to standardize the iodate when once its true value has been found.

There are no interfering elements except silver, which should be filtered off when present in appreciable quantities. Arsenic, antimony or lead have no influence on the assay. After using this method for two years, we have still to find where it has fallen down in any way, and believe it is equal generally to any other volumetric method for copper and superior in many respects.

Detection of Infinitesimal Amounts of Arsenic

The method is based upon the deposition of a mirror of silver by the action of the hydrogen arsenide upon a solution of silver nitrate contained in a narrow glass tube bent twice at right angles, and comparing the mirrors obtained with standard mirrors (L. Moreau and E. Vinet, *Comptes rend.*, p. 869, 1914). The arsenic hydride is generated in a small U-tube, containing 0.5 grams of platinized zinc and dilute sulphuric acid. One limb of the U-tube is connected with the above-mentioned glass tube and the other with a dropping funnel containing the solution under test, and with a hydrogen generating apparatus through a second U-tube containing silver nitrate solution; the current of hydrogen is regulated to give 15 to 20 bubbles per minute in the mirror tube. By this method 0.001 mg. can easily be detected and estimated, but care must be taken not to use more than the specified quantity of the "purified" reagents.

Iodometric Equivalents

The following table from the *Chemical Engineer*, June, 1914, is a convenient one for pasting up in the laboratory:

THIOSULPHATE AND IODINE EQUIVALENTS

$Na_2S_2O_3$ value	× 0.8022	=	iodine value.
$Na_2S_2O_3$ value	× 0.2241	=	chlorine value.
$Na_2S_2O_3$ value	× 0.5051	=	bromine value.
$Na_2S_2O_3$ value	× 0.2747	=	MnO_2 value.
$Na_2S_2O_3$ value	× 0.1292	=	$KClO_3$ value.
$Na_2S_2O_3$ value	× 0.1461	=	$KClO_4$ value.
$Na_2S_2O_3$ value	× 0.1096	=	chromium value.
$Na_2S_2O_3$ value	× 0.4367	=	lead value.
$Na_2S_2O_3$ value	× 0.1517	=	ozone value.
Iodine value	× 1.2465	=	$Na_2S_2O_3$ value.
Iodine value	× 0.2953	=	arsenic value.
Iodine value	× 0.4722	=	antimony value.
Iodine value	× 0.1263	=	sulphur value.

Use of Tantalum Electrodes

Wegelin (*Chem.-Zeit.*, 1913, p. 989) obtained better deposits of zinc and copper on a platinum-wire-gauze cathode than on one of perforated sheet tantalum. This, however, is to be attributed to the different forms of the electrodes, for with an electrode of tantalum-wire gauze, deposits were obtained equal in quality to those obtained with a platinum-gauze cathode under similar conditions. Oesterheld found that tantalum cathodes became brittle in use. This is true, however, only when relatively high current densities are used, and does not apply to electro-analytical operations.

"Policeman" for Platinum Crucibles

A neat "policeman" for platinum crucibles is made of a piece of heavy platinum wire, or old anode stem, flattened so as to give a chisel point. This is then mounted in a wooden handle. To avoid scratching the crucible, the corners of the chisel end may be slightly rounded. This is a very useful tool in dislodging deposits on the side of the crucible, such as form in hydrofluoric evaporations.

Correspondence and Discussion

Placer Law Applied to Petroleum

Not havin' much to do the day, I've been studyin' Misther Ball's larned discoorse on "The Placer Law as applied to Petrolyum," as contribyted to the Institoot last Fibruary, and am now pretty well balled up on the subject. I agree that the placer law is highly unsatisfaact'ry.

The ixtra-latheral rights of ile drillers is touched on be Misther Ball, but he does not seem to make anny attimpt to classify ile deposits and ile wells as veins or lodes. Now it shud be plane to anny wan at all that an ile well is a kind of artery or artificially created apex to a vein. It extinds down into the heart of the earth, and the heart of the earth takes the ile from the vein and poomps it up the artery.

Whin the heart action is weak, the ile man pulls the ile up with a poomp. An' the felly with the biggest pull gets the ixtra-latheral rights, and there ye are.

BILL MCGINTY*.

El Paso, June 20, 1914.

Ore Treatment at the Argo Mill

In the JOURNAL of July 4, in an article on "Ore Treatment at the Argo Mill," by A. H. Roller and H. T. Curran, the authors assume credit for having successfully applied cyanidation to the complex ores of this Colorado district, attributing the success to the use of an electric cell placed at the head of the zinc boxes, and to the use of ammonium salts.

The use of ammonium salts is not new to the metallurgical fraternity, but such success as attended the use of these salts at the Argo mill may be new and worthy of note. It is claimed that by virtue of ammonium salts, the precipitation of copper in the zinc boxes is prevented. (See table below.) That the use of the electric cell is a "distinctive feature" aiding precipitation, oxidizing the reducing agent in the solution, and beneficially toning the whole system, may best be judged by the following comparison of results, with and without its use.

COMPARISON OF PRECIPITATION

Period	Electric Cell	Ammonium Salts	Zinc in Use, Cu.Ft.	% Bullion in Precipitate		Ratio of Bullion to Copper	Fineness of Cast Bullion	Gold in Box Tail
				Low	High			
Apr. 1 to Nov. 1 1913	With	With	234	1.2	6.4	1 to 0.9	397 (*a*)	16.7c.
Jan. 1 to July 1 1914	Without	Without	78	14.6	25.6	1 to 0.7	720 (*b*)	6.6c. (*c*)

(*a*) Only one bar of bullion cast in the period, the precipitate having been shipped regularly to the American Smelting & Refining Co., Omaha, for treatment.

(*b*) Low-grade bullion due to copper. By special treatment of the precipitate, this grade of bullion is now about 900 fine, none of which is included in the average of 720.

(*c*) At present, with 90 cubic feet of zinc, the box tail seldom exceeds 2c.

*Ex-sicrety, Durango local lodge, Amalgamated and Disintegrated Federation of the Ex-patriated Plaza Miners of Greater Texas. Expelled by other Plaza miners for doing a little real work.

Commercially speaking, the successful application of cyanidation, or any other method of ore treatment, implies at least that the bare operating expenses shall be covered. As this mill had at no time, up to the time of change in management, on Nov. 1, 1913, paid operating expenses, it is difficult to see wherein the venture was a success. The mill was in unsuccessful operation from Apr. 1, 1913, to Nov. 1, 1913. In October, Richard A. Parker, of Denver, was appointed consulting engineer to the company. After a careful investigation, he shut down the mill. He then appointed O. F. Heizer as manager, who in turn appointed me mill superintendent.

In November, under the new management, a test run of five days was made, at the end of which period, the mill was closed down pending radical alterations, touching nearly every department of the mill—sampling, crushing, concentration, agitation, filtration, precipitation and refining. These alterations have been made, notwithstanding the statement "any future changes will be small details governed by convenience." That the extraction has increased from 59.8% (Apr. 1 to Nov. 1, 1913) to over 90% (at present) seems to justify the alterations.

JACKSON A. PEARCE.

Idaho Springs, Colo., July 17, 1914.

In the JOURNAL of July 4, Mr. Roller and I had an article on the Argo mill. This article was written before the change of management, but was not sent in until shortly afterwards as we were holding off to get some details on the filter which we were installing. I severed my connection with the company at that time and Mr. Pearce has since been mill superintendent.

I am connected with the Oneida-Stag Mining & Milling Co. as mine and mill superintendent and I am sure Mr. Roller, when he sent in the article, did not wish to convey the idea that I was still connected with the Argo mill. In justification of Mr. Pearce's position, I will greatly appreciate any effort of the JOURNAL to give due publicity to the fact that he has been superintendent since the change of management.

HARRY T. CURRAN.

Idaho Springs, Colo., July 19, 1914.

What Is a Prospector?

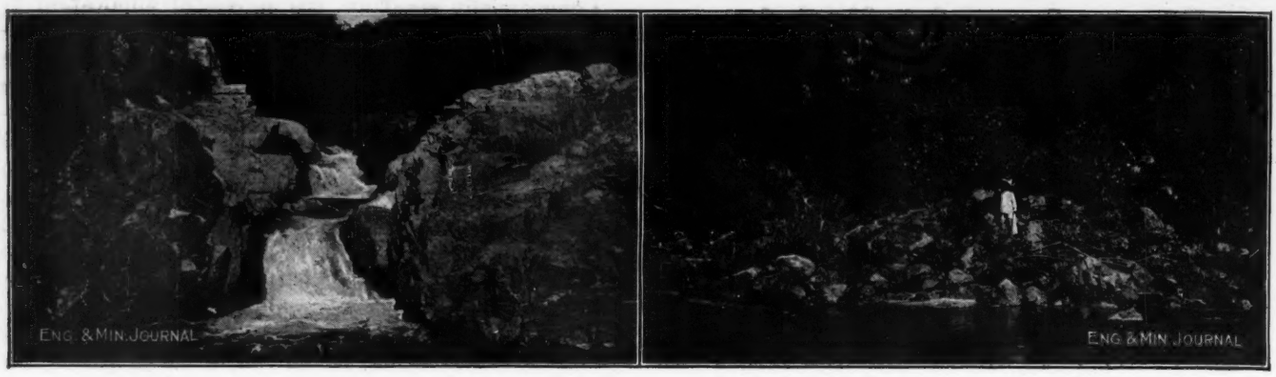
Regarding the analysis of a prospector in the JOURNAL of July 4, I am a good deal of a prospector myself, in that case you can take off the 22.5% of alcoholism; I never taste any. The other qualities you may let go.

I have found on many occasions that a few dollars invested with a hardy prospector or practical miner will return with up to 1500% more, sometimes within a year. I have myself on many occasions invested a good deal of money with technical mining experts, but so far have never yet got a dollar back. Every cent a total loss, and this has gone into the thousands of dollars.

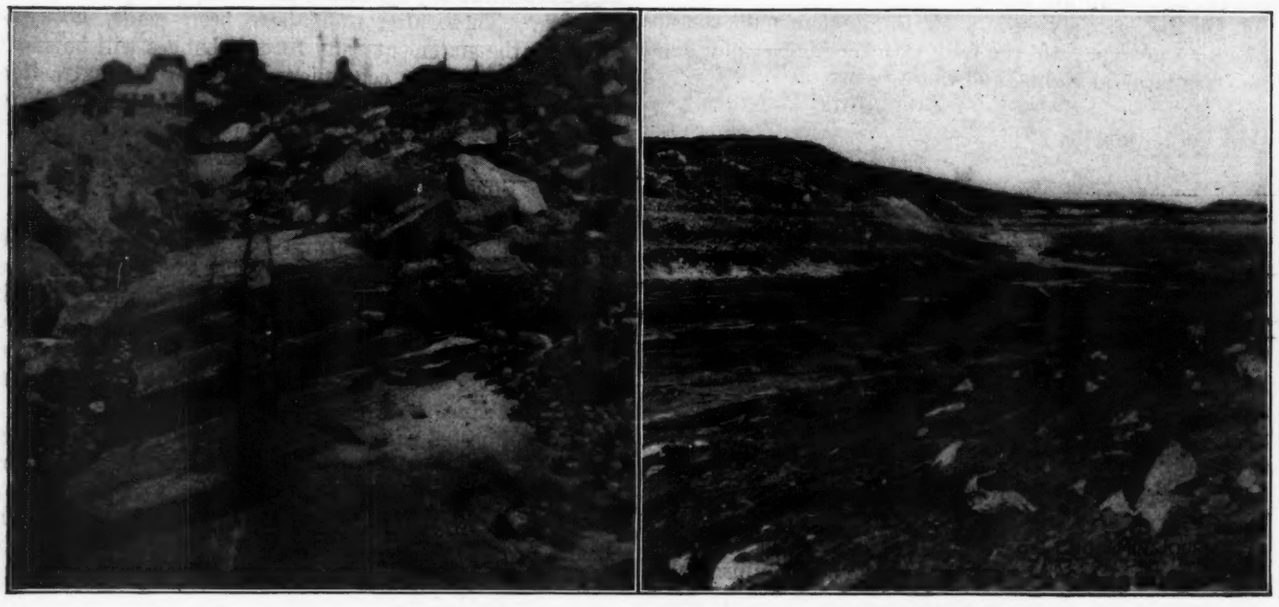
G. C. MONBERG.

Leadville, Colo., July 12, 1914.

Photographs from the Field

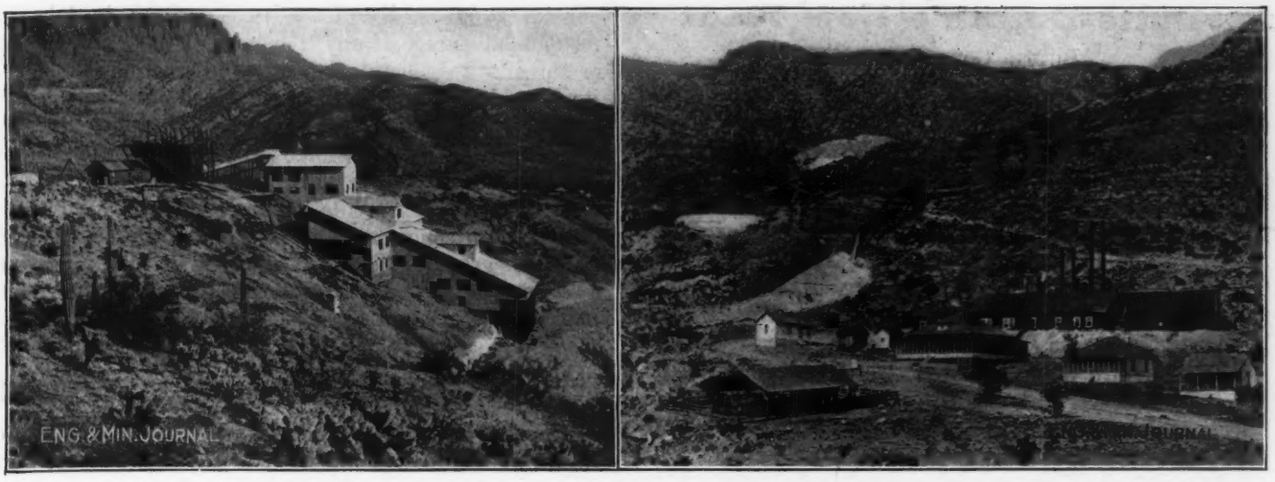


LAS TRUCHAS IRON-ORE DEPOSIT, MICHOACAN, MEXICO
Views show ore in bed of a stream and float ore on the bank.



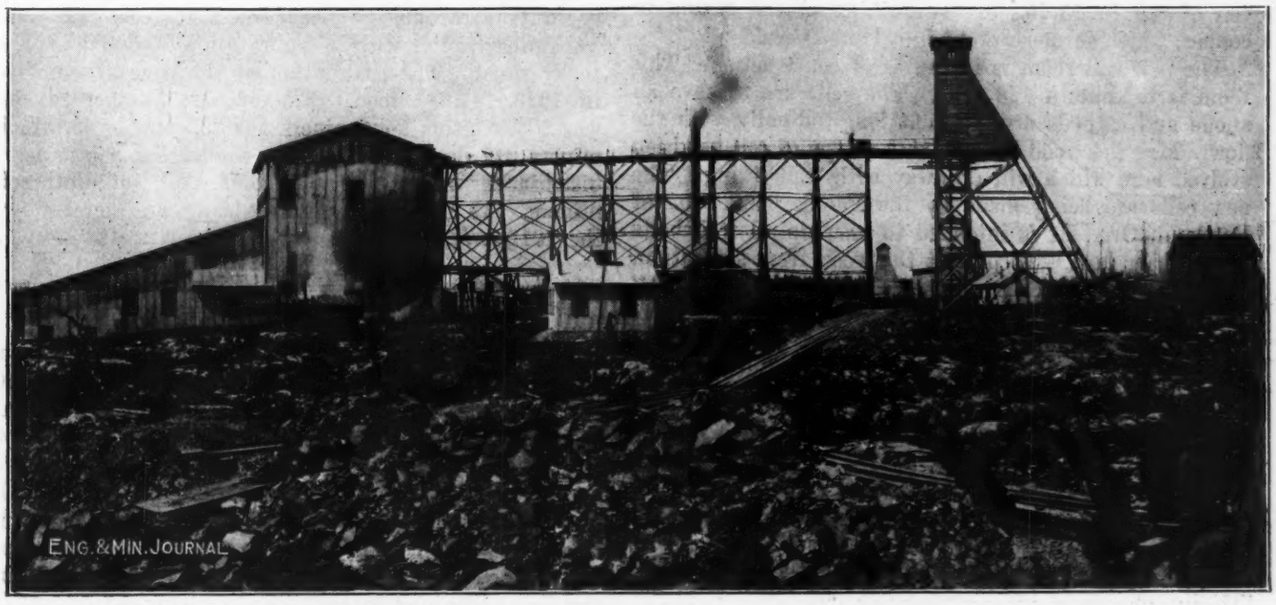
BED OF KERR LAKE, ONTARIO, AFTER WATER WAS PUMPED OUT
The view on the left shows one of the veins found. This vein yielded "plate silver" and assayed 2500 oz. per ton.

GENERAL VIEW OF CLARKDALE, ARIZONA, AND NEW SMELTING WORKS
The older smelting works at Jerome is barely distinguished. It appears faintly, more than half way up the mountains and a



MILL AND MINE PLANT OF MAGMA COPPER CO., SUPERIOR, ARIZ.

The mill, recently started, is of 150 tons daily capacity, treatment consisting of table concentration followed by Callow process of pneumatic flotation. Lower terminal of the tramway is the unfinished structure at head of the mill. The town of Superior is in the distance at the right. The view at the right shows the assay office, mine office, power plant (back), dormitory and mess hall. The uppermost dump is at the old Magma shaft, now abandoned. Principal mine opening is the Flindt adit.



DOME LAKE MILL AND HEADFRAME AT PORCUPINE, ONTARIO

Mill crushes about 40 tons of ore daily, recovery of gold beingeffected by amalgamation only.

OF THE UNITED VERDE COPPER CO., NOW NEARLY READY TO BE BLOWN IN

little beyond the faint white line of the road that disappears to the right of the center of the left half of the photograph.

Butte-Duluth's New Plant

BUTTE CORRESPONDENCE.

Butte-Duluth's new crushing plant, new leaching machines, Dorr thickener, Kelly filter press and electric haulage were started simultaneously not long ago, rendering the hands of the operating staff pretty full. However, things went very well, there having been a minimum of incidental starting troubles.

The Kelly filter press, working under an entirely new condition, is performing excellently well, giving a clear electrolyte and perfectly washed slime tailings. The Symons machines in the crushing plant, both vertical and horizontal, are doing excellent work. The fine reduction disk, or vertical, has several minor mechanical defects, which are being remedied, but it has the ear marks of becoming an efficient grinding machine.

The 8x30-ft. Dorr machines are started and are operating in an ideal manner. They are giving an extraction on an average of seven days of 92.1%. The addition of Dorr thickener and Kelly filter press to take care of the slime discharge from the leaching machines has cut the acid consumption from about 72 lb. of 60° Bé. per ton of ore to 45 lb., to say nothing of the saving in copper, which formerly went into Horse Creek.

The new cell room is in course of construction. This room is to contain 128 cells. The cells are to have an anode and cathode arrangement longitudinally with the flow. Mr. Sherwood believes that a type of cell has been evolved here which will do away with lead lining. The new cells are being made by the Pacific Tank Co., of Portland, Ore. It is intended to insulate all iron bolts with rubber hose. To protect the wood from saturation, the interior of the cells will be coated with "Amberoid." This is a new acid-proof lacquer evolved in the laboratories of the Mellon Research Institute of the University of Pittsburgh, by Dr. L. V. Redman. The Butte-Duluth company has had in operation a cell made as above, and has had good success with it.

The Unprofitableness of Graphite Mining

The following remarks on the financial hazards of graphite mining in the United States are taken from the U. S. Geological Survey's bulletin on graphite.

Today there are more abandoned graphite mines and mills in the United States than the number in operation. The number of times that some of these properties have changed hands in the course of a few years evinces a record of misrepresentation and disappointment that can hardly be equaled in any other branch of mining, and many properties have been notoriously associated with stock manipulations of doubtful character. It should be clearly understood by anyone who contemplates the development of one of the flake-graphite deposits that the technology of concentrating such materials is yet in its infancy; that there are no well established systems of treating the materials, such as exist, for example, for the treatment of gold or copper ores; and that the product obtained is variable in quality and in market value and subject to severe competition with foreign graphite. The largest part of the foreign graphite that comes into this country is brought in by American firms, who either control or own foreign mines or have purchasing agents abroad, and are, therefore, in a position to take immediate advantage of any change in the markets at home or abroad. In general, the cost of producing flake graphite is so high and the price at which it is sold so low that even under the most economic conditions the margin of profit is small. Moreover, certain rocks that carry graphite contain other minerals in such intimate association with the graphite as to preclude any possibility of successful concentration—such, for example, are rocks in which graphite flakes are interleaved with mica—and a careful study of the material by an expert should precede any attempt at development.

U. S. Coal Production in 1913

There was a record production of coal in the United States in 1913, amounting to 570,048,125 short tons, according to the report of Edw. W. Parker, of the U. S. Geological Survey. This is an increase of more than 35,000,000 tons over the production of the previous year.

Coal was produced in 29 states, 23 of which showed increases. The decrease in Colorado was due solely to labor troubles. The largest increase was made by Pennsylvania, with West Virginia second and Kentucky third. The coal mines of the country employed in 1913 747,644 men. The average number of days worked by bituminous miners was 232 and by anthracite miners 277 days. The average production per miner in bituminous mines was 838 tons, and for anthracite miners, 532 tons, both figures being an increase over the 1912 average.

Winona Copper Co.

The 1913 report of the Winona Copper Co., Winona, Mich., shows a balance of assets amounting to $74,508 and unpaid assessments of $43,624, of which $21,079 have been paid since making out the statement. The receipts, exclusive of assessments, were $228,695, and expenditures were $344,727. The production was 1,448,737 lb. of copper from 120,806 tons of rock, yielding 11.99 lb. of copper per ton. The average price received for copper was 15.4c. The following table gives the cost of regrinding the jig and finisher-table tailings with six 8-ft. by 36-in. Hardinge mills. With three mills in operation in 1912 the copper recovered by regrinding amounted to 1.2 lb. per ton stamped. With six operating, the recovery amounts to 2.4 lb. per ton stamped, although the grade of the rock was lower.

May to Dec. 31, 1913	Total	Cost per Ton Reground c.	%	Units per Ton Ground
Power, 1.094c. per kw.-hr.	$8,186.98	15.30	80.23	13.99 kw.-hr.
Labor	404.31	0.76	3.99	
Supplies:				
Pebbles, 0.7226c. per lb.	933.24	1.74	9.12	2.414 lb.
Lining, 1.467c. per lb.	117.52	0.22	1.15	0.15 lb.
Set steel lining	176.55	0.33	1.73	
Incidentals	383.80	0.72	3.78	
Totals	$10,202.40	19.07	100.00	

Sulitelma Mines, Norway, Produced in 1913 165,000 tons of pyrites and 1385 tons of bessemer copper. The profits for 1913 amounted to $264,720, and a dividend of 6 per cent. was declared. Last year the shareholders got nothing, the whole of the earning being devoted to writing off. Last winter the new modern smelter of American type was put up, and the Ovre lakes kept open by means of the steamer "Ranen," loaned from the Dunderland Co. until the modern type ice-breaker on order is delivered next autumn.

Editorials

The War in Europe

Austria has arrogantly and wickedly declared war on Servia in revenge for the assassination of the Archduke Franz Ferdinand and to satisfy the ambitions of its army. The world is fearful that all the great nations of Europe will become involved, and the markets of all kinds, both stock markets and commodity markets, but especially the former, have experienced cataclysms. Our own markets have not escaped; so closely are they tied to the markets in Europe. The probable effect of a general European war upon business in the United States is excellently outlined by Frank A. Vanderlip, president of the National City Bank, as follows:

As far as this country is concerned it would of course be adversely affected by such a great war as Europe is trying to avoid. As we have no merchant marine of our own, we would find our ability to ship our industrial and agricultural products to Europe restricted, as the French, German and English merchant marine would not be able to operate as it does today. Such a condition would result in a depression of our industries for the time being.

No good can ever come of warfare, for it is destruction of capital, and capital makes prosperity. The idea which some people have that a war would be beneficial to this country is a theory which belongs to the stone age of economics. If we get more for our goods abroad in case their industry there is paralyzed by war we will also have to pay the higher prices at home. I can hardly imagine a great European war of such long duration as to enable our building up a great merchant marine of our own.

Such a war would prove a great hindrance to the necessary financing which many of our great industrial plants and railroads must do in the very near future. It would hold back such reorganizations as are absolutely necessary to readjust railroad properties in this country.

As we go to press the only hope is that hostilities may be confined to the two countries, Austria and Servia, directly involved at present. If diplomacy can avert the spreading of the conflagration that is the best to be expected. It appears from the Austrian newspapers that this conflict was urged there as early as the beginning of July, but upon the world at large the prospect burst only a few days ago like a bolt out of a clear sky.

Copper below 13 Cents

But little more than six months ago the producers of copper were confidently expecting an upward swing of the market. Indeed, conditions were regarded as such that the price might be carried up to 18c., even to 20c. This was when Europe was taking enormous quantities and when a revival in American business was expected to take place immediately. The new currency bill had just been passed and had been accepted even by its previous critics as an important step toward the rehabilitation of the commercial structure in this country. The President had just made a reassuring statement to the people regarding the attitude of his administration toward business affairs. The stock of copper was phenomenonally low. Production had been for many months previous about at a standstill and no important increase was in sight. The conditions justified the optimistic opinions respecting the copper market that were then held. Instead of their fulfillment, however, we have seen what we have seen, including during the last week a fall in copper to below 13c.

It is unnecessary to repeat our reviews of the causes leading to this. Suffice it to say that the contraction in American consumption has been the basic cause. Early in July an attempt to turn the market was cleverly engineered and during that time some large transactions were made, but although the market was raised fractionally, it developed quickly that the demand from consumers was not sufficient to hold the advance, discerning which producers became insistent sellers again and once more the price sagged off. On this slump the interest of Europe failed to be awakened, which, no doubt, was due in a considerable measure to apprehension over the political conditions which culminated in the war scare beginning last week.

During recent weeks the Wall St. and minor trade papers have given a wholly erroneous, uninformed idea of the conditions actually existing in the copper market. In fact, it has been difficult for producers to dispose of their output, all are averse to carrying unsold stock, and each one has been afraid that his competitors would get ahead of him in disposing of product. The conditions have demanded the shrewdest kind of marketing, in executing which no seller parades his real prices from day to day, and if he talks he talks big in order to make his wares look good. Nor does the producer who has millions of pounds weekly to merchandize among consumers disclose his hand to picayune buyers and petty speculators.

Copper has been weak for a fortnight previous to this review and has been emphatically weak since July 20, when there began to be a pronounced pressure to sell. All the facts of a market may not always be told from week to week lest some confidences be betrayed, but at this late date there is no harm in disclosing that the rallying of the market in the first week of July was an experiment that failed, or rather it was a testing of conditions which were found to be unsatisfactory, and that the hesitation of Europe to enter into further contracts for supplies became evident a good many days ago.

A Novel Proposition in Butte

The proposition of the Butte Miners' Union, the old union, that the city of Butte should indemnify it in the sum of $138,291 for failure to protect its property, which was destroyed in June, is a novel one. In ordinary circumstances, the complainants might have some justification, although the destruction of property by the sudden attack of a mob, which no municipality could combat effectually, might be classed with those things that are characterized as acts of God, for which the municipality is no more responsible than for failure to protect property against fire by not having an efficient fire department.

The miners' unions have, however, openly threatened to destroy the properly of their employers upon occasions when some of their demands have not been granted, and, in fact, have done so in the Cœur d'Alene, at Cripple Creek, and elsewhere, and most recently in the coal fields of Colorado. The objection to such a practice when applied the other way around and a claim for damages on such an account looks cheeky. But it simply illustrates what a difference there may be in whose ox is gored.

Unit Construction Costs

That is a very noteworthy paper which E. Horton Jones publishes in the July bulletin of the American Institute of Mining Engineers on "Unit Construction Costs from the New Smelter of the Arizona Copper Co., Ltd." This was a new smelting works erected by Mr. Jones, under the general direction of Dr. L. D. Ricketts, at a cost of about $2,000,000. Mr. Jones with the assistance of his staff summarized the cost with a minuteness that perhaps is unrivaled. Anyway, we are safe in saying that nothing equal to this has heretofore been published, and the engineering profession owes a great debt both to Mr. Jones and to Dr. Ricketts for allowing these data to be published.

Mr. Jones treats his subject in five chapters, as follows: Unit costs, comparative costs, composite costs, wage scale, raw materials prices and description of costs. Taking up these chapters in the reverse order, the last is to some extent a description of the works, or, rather, of such portions of them as give the necessary information for anybody to determine the character of the work and judge as to the applicability of a unit cost in another place. The chapters on the costs of material and labor are of course basic, these being fundamental factors that come into any estimate. In composite costs we find everything grouped according to divisions of the works, such as the cost of the several buildings, of the ore bins, of the dust chambers, of the power plant, etc. In comparative costs we find data of the expense of putting in the concrete work, of excavation, of erecting machinery, structural steel, etc. In the chapter on unit costs, we find the cost of the plant, in detail, allocated in a different manner from that in chapter 3, here being given the cost of the crushing plant, of the sampling plant, of the roasting plant, of the reverbatory plant, etc. Everything is given in minute detail and everything is reduced to the unit cost, viz., so much per cubic yard, or per linear foot, or per ton, etc.

Many years ago we inaugurated in the JOURNAL a discussion of the cost of mining, hoping to develop data analogous to what Mr. Jones has done in this paper for smelting. This discussion brought out a great deal of interesting material, but it failed singularly to bring out what we wanted, and we were forced to the conclusion that the mining engineers of the country, speaking generally, did not possess that kind of data and had not been trained to think in the way necessary to produce it. No doubt the same criticisms might have been correctly made with regard to the practice in smelting and the erection of metallurgical plants. Mr. Jones has, however, demonstrated that he is a thinker on the subjects of his profession, and we prophesy that his recent contribution will not only be a stimulus to other engineers to think likewise, but also will be of immediate value to smelting men and builders of metallurgical works everywhere; to them indeed his paper will become a well-thumbed *vade mecum*.

More Flotation Litigation

The Minerals Separation Co. is going to try out its patent litigation once more. Having been denied a rehearing in the Circuit Court of Appeals, where the previous decision was rendered, its only resource was to bring suit in another circuit. Consequently it selected the Miami Copper Co., which is a Delaware corporation, and has brought suit in Delaware. Obviously this is distinctly a test case, inasmuch as the Miami Copper Co. has been trying the flotation process only in an experimental way, and probably no damages will be claimed.

Mining a Flat Vein

The objects in life of a mining engineer are to find ore and to break and handle it cheaply. Of all the handling operations, the first one, mucking, is most neglected. Tramming and hoisting have been mechanically developed to a high degree, but, as one engineer has put it, we are mucking today about as they did in Solomon's time.

The problem has, of course, been attacked to some extent; the most successful way to solve it is to eliminate it by a generous use of chutes, as at the Ray mine. In cases where this is impossible, mechanical loaders are being experimented with, and undoubtedly will be developed into successful machines in time, although none has as yet won any spectacular success. There will always be cases, however, to which neither of these solutions is applicable, and the hardest problem which the miner meets is that involving a flat-dipping deposit, say 10° to 30°, narrow or of medium thickness, and not of any great extent in its other dimensions. In such an orebody the man-handled muck-stick is likely to be used for a long time yet, and under such conditions the mucking, that is, getting the broken ore to the haulage level, is likely to cost about as much as the actual breaking.

Various expedients are resorted to for overcoming these adverse conditions, shaking chutes and gravity trams being most commonly used. In this issue Mr. Newberry describes the ingenious scheme worked out for the Golden Cross mine in southeastern California. It was necessary here to keep all costs low, and especially all initial costs. The stopes were small and the amount of ore to be handled in each was not enough to pay for any elaborate installation. Development was relatively expensive, due to the faulting, and the processes of mining and development had to be combined to as economical a whole as possible. We believe that the method adopted was about the most suitable that could have been devised, and was in most features unique. The only similar scheme with which we are familiar, and that differs in a good many particulars, is one found in some of the anthracite mines.

The costs are low, considering that the only even partially favorable conditions encountered were a fair thickness of the ore, a material not exceedingly hard, and apparently a sound hanging wall.

Leaving the question of mining and stoping, the adoption of raises for transverse exploration, instead of crosscuts, was a happy idea. The material from the raise

requires no mucking; the use of the economical stoping drill is permitted; the raise is available for a chute when ore is encountered, whereas a crosscut is frequently wasted; and, finally, with the dip here existing, the raise is the shortest way across the possibly ore-bearing formation. It is hard to see why this scheme does not find a more general adoption.

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The total production of coal in the United States in 1913, according to the figures collected by Edward W. Parker, statistician of the Geological Survey, was 570,048,125 short tons. This is 35,581,545 tons more than in 1912, and is the largest output ever reported. Coal was mined in 29 states, nearly all of them showing gains over the previous year. About 46% of the total came from Pennsylvania.

BY THE WAY

The Potomac Glass Co., of Cumberland, Md., capitalized at $25,000, on a business of $160,000 during the fiscal year just ended, declared a dividend of 92%. Most of the company's shares are owned by its 300 employees, consisting of men, girls and boys. The plant runs day and night and has orders ahead for over a year. The first dividend of 10% was declared in 1910 after eight years of operation. Other dividends were: 1911, 32%; 1912, 62%, and 1913, 72%. Do these enterprising, intelligent and thrifty cooperative working people appreciate what a crime they are committing in paying themselves dividends of nearly 100%?

⁂

One of the most amusing and characteristic happenings which spice the history of the late Jim Wardner, the promoter, is reported by *The Chalcopyrite,* of Skeena Crossing, B. C., as follows: A railway train upon which Wardner was traveling was stalled for an hour or two in a little town. While wandering aimlessly about the place, he strolled into its one grocery store, and seeing a small pan of eggs on the counter asked: "Are those eggs fresh?" "Wife fetched 'em in from the hen-house this mornin'," said the grocer. "It's a long time since I had a real old-fashioned egg-nog," said Jim, "and if you will furnish the eggs I will provide the whiskey and other ingredients, and we will have a most enjoyable drink." "I'm quite willin'," was the response. Crossing the street to a saloon, Wardner gave the proprietor a pleasant greeting, and after a few introductory remarks about the weather and the crops, said: "By the way, I have just discovered some fine new-laid eggs over in the store, and if you will furnish the whiskey I will arrange for the eggs and we will have an uptodate egg-nog." "It's up to you," replied the saloonkeeper. Back across the street went Wardner and straightway returned with the grocer and his eggs. The saloonman did his best and soon placed upon the bar three foam-crowned glasses of the beverage. Suddenly a puzzled expression appeared on his face and he asked, "Say, stranger, this man furnished the eggs, and I have put up the rest of the material, now where do you come in?" Said Jim, with a smile, as he raised the glass to his lips, "I am the promoter."

The following extract from William Ogilvie's "Early Days on the Yukon," indicates clearly how excessive conservatism may retard the development of rich mineral territory. In the year 1859, a young man of the city of Toronto, Canada, entered the service of the Hudson's Bay Co. and was sent to the other end of the world, as it was considered then, to the company's most distant post, Fort Yukon. In the fall of the year soon after his arrival he wrote a long letter home, giving a minute account of his journey of nearly five thousand miles. On Oct. 2, 1864, he wrote again, and told of the fur trade and its dog expeditions in the winter, and boat voyages in the summer after furs. I have copies of both these letters, and though all the contents are interesting, the following paragraph is extremely so, as foreshadowing the future of the Yukon: "I had some thoughts of digging the gold here, but am not sure about it. I do not think it is in paying quantities at the fort, but if I could only get time to make an expedition up the Yukon, I expect we should find it in abundance, but I am always on the voyage or busy at the fort during the summer, and in the winter nothing can be done in the way of gold hunting. I think that next fall, after arriving from my trip down the Yukon, I shall be able to go up the river. There is a small river not far from here that the minister, the Rev. McDonald, saw so much gold on a year or two ago that he could have gathered it with a spoon. I have often wished to go, but can never find the time. Should I find gold in paying quantities I may turn gold digger, but this is merely a last resort when I can do no better."

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It is not universally known that at one time several Standard Oil men were interested in prospecting for gold placers. But we are informed that in 1898 some of these gentlemen organized what was known as the Principality Mining & Grazing Co., for the purpose of exploiting a large tract of land in the Northwest Territory of Canada; having been led to believe that the Canadian Government would grant to them a concession to operate in that region. When matters reached an encouraging stage, an experiment was tried in order to test the feasibility of selling leases to prospective gold miners; and in one afternoon several were sold in one locality at a price of $1000 each. Lieut. S. F. Adair, formerly with the Fifth Cavalry, U.S.A., was commissioned to negotiate with the Canadian officials, and when Lieut. Adair's doubts as to the securing of the concession were confirmed, he advised his principals to make no attempt to sell leases. Unfortunately those already sold could not be canceled, as the purchasers insisted upon the terms of the contract being carried out. This task was entrusted to the ex-cavalryman, and in order to secure sufficient ground for all, a like number of additional miners was employed from Pacific Coast points. Early Klondikers may recall the "mysterious thirty-six," who would not reveal their ultimate destination. They would not because they could not. Nor did their military guide have a precise knowledge as to where the goal might be. He simply knew that it was "up to him" to produce the goods. In due time each lease buyer was placed in possession of a placer claim of suitable size and the precious contracts were returned to New York. Needless to say, the Principality Mining & Grazing Co. did not continue its operations.

Sinking the Athens Shaft

SPECIAL CORRESPONDENCE

Sinking is again in progress at the Athens mine, which the Cleveland-Cliffs Iron Co. is developing, near Negaunee, on the Marquette range, and almost all of the permanent equipment is installed. It will be several years, however, before mining can be started. The shaft will be sunk below 2000 ft., and it is figured that an average of 80 ft. per month will be excellent sinking. The shaft is circular, 17 ft. in diameter in the clear, but is being cut to 20 ft. It will be concreted from the top to the bottom.

The cement is poured into the forms through a 6-in. pipe. The segments of steel plate which form the outer circumference of the circle are 5 ft. high and well reinforced, and two of these circles, making 10 ft. in height, represent the spacing of a steel set. The steel members crossing the shaft horizontally have studs at each end, 18 in. long, which are bolted to the main piece and firmly held in position by plates on each side of the member. There are holes cut in the steel forms to receive these ends. The ends, or studs, remain permanently in the concrete, the rest of the member being withdrawn when the forms are removed and again bolted into position when the work is ready. The timbering for any portion can be easily removed in this manner. The shaft will have two skip-ways, a cage-way and pipe- and ladder-ways.

A cage is being used in the sinking, the first time in this part of the country that such has been tried. It is working well. The idea was developed by S. R. Elliott, superintendent of the Negaunee mines of the company. The cage is surmounted by a substantial steel crosshead, through which are strung three cables. At a distance of 100 ft. above is another crosshead of wood. When the cage descends into the shaft, the lower crosshead is caught at the point where the bearers cease and from this point to the bottom of the shaft it is kept in line by the cables which run through the crossheads. In hoisting, the cage comes up into the guides accurately and freely. A large Lake Shore Engine Works hoist is used, and the compressor is of the Nordberg type. The headframe is of steel, 110 ft. high. The engine house stands on a hill 520 ft. from the shaft, the cable being carried on towers 80 ft. apart. The tower nearest the shaft is 100 ft. high.

Double Dealings by Representatives of Companies

BY A. L. H. STREET*

It is an actionable wrong against a mining company for its superintendent to enter an agreement with a lessee of the company whereby the superintendent is to receive a percentage of the lessee's profits under the lease, unless the company is fully apprised of the nature and extent of the agreement, according to a recent decision of the Nevada Supreme Court, announced in the case of Frances Mohawk Mining & Leasing Co. vs. McKay, 141 *Pacific Reporter* 456. The Court said:

The law will not tolerate an agreement or understanding between one principal and the agent of another, by which agreement such agent is to receive a commission or reward, which gives the agent an interest against his duty to his principal. In other words, an agent cannot be allowed to put himself in a position in which his interest and his duty will be in conflict, and, if he does, any profit that he may derive in the execution of his new assumed position must be accounted for to the principal who may claim it as a debt for money received for his use. Any gratuity to an agent, after he has entered into his agency, given to him for the purpose of influencing the execution of his agency, must be accounted for to his principal.

*Attorney, St. Paul, Minn.

Clayton Bill and Compulsory Sales

WASHINGTON CORRESPONDENCE

In reporting the Clayton trust bill, on July 22, to the Senate, the Senate Judiciary Committee has made, as the new draft of the measure shows, an important change in the form of the bill sent over by the House of Representatives, insofar as relates to mining. The Committee has left out of the bill entirely section 3, which read as follows:

"That it shall be unlawful for the owner, operator, or transporter of the product or products of any mine, oil or gas well, reduction works, refinery, or hydro-electric plant producing coal, oil, gas, or hydro-electric energy, or for any person controlling the products thereof, engaged in selling such product in commerce, to refuse arbitrarily to sell such product to a responsible person, firm, or corporation who applies to purchase such product for for use, consumption, or resale within the United States or any Territory thereof or the District of Columbia or any insular possession or other place under the jurisdiction of the United States, and any person violating this section shall be deemed guilty of a misdemeanor and shall be punished as provided in the preceding section."

Speaking of the reason for striking out this section, the Judiciary Committee says: "It would primarily deny freedom of contract to one of the parties, and consequently would be of doubtful constitutional validity. Passing from this consideration, the committee believes that such an enactment, which would practically compel owners of the product named to sell to anyone or else decline to do so at the peril of incurring heavy penalties, would project us into a field of legislation at once untried, complicated and dangerous."

Mine Rescue Car in California

The U. S. Bureau of Mines Rescue Car No. 5 will be in California early in September. The car will be first at Auburn, Placer County, from which point it will work the Grass Valley and Nevada City district. On account of the narrow-gage tracks of the local railroad, the car cannot go actually into these two districts. After completing its work in that section of the state the car will go into the Mother Lode region.

A. A. Krogdahl, first-aid miner with the Bureau of Mines, has been training men in first-aid work in the Mother Lode region. He is working at Plymouth, Amador City, Sutter Creek, Jackson, and from there will go to Campo Seco and Angels Camp, whence he will work south along the Lode. It is planned to have him visit most of those mines in the state that are situated off the railroad.

The Raritan Copper Works Now Issues a Safety Magazine, the "Ingot." A particularly good feature is an illustration each month of how some prevalent form of accident happens and how it can be avoided.

PERSONALS

Kirby Thomas is making examinations in the San Juan district, Colorado.

Edward C. Weatherly has returned to Ouray, Colo., after spending six months in London.

R. B. Stanford left New Orleans July 23 for Choluteca, Honduras, to be gone two months.

Theodore V. K. Swift will sail for Cuba on August 8, where his address will be care of Tuinucu Sugar Co., Tuinucu, Cuba.

Floyd S. Youtsey, of Denver, Colo., is erecting a mill for the St. Louis Smelting & Refining Co. at St. Francois, Missouri.

Robert P. Millard, Mining Engineer, announces the opening of new offices at 1424 Rockefeller Building, Cleveland, Ohio.

Morton Webber, who has been engaged in Idaho on examination work for New York interests, has gone to Montana on professional business.

Frederic E. Calkins, of Globe and Miami, recently with the American Smelting & Refining Co., has been made mine inspector by the mining companies at Morenci, Arizona.

W. J. Priestley, Jr., former superintendent of the Alaska Treasure mine of Juneau, is now in charge of the Washington Anthracite Coal Co.'s property near Glacier, Washington.

Charles P. Aicher, late manager of the Butte Mining Co. of Alma, Colo., has accepted the position of manager of the London Mines & Milling Co., which operates the London Mine in Park County, Colorado.

H. N. Thomson, formerly of Anaconda, Mont., and Tooele, Utah, is at Clarkdale, Arizona, for the present. He is acting in the capacity of consulting metallurgist at the new plant of the United Verde Copper Company.

Horace Young, recently with the Trethewey mine, Cobalt, Ont., has accepted the position of consulting engineer with the Alguinican Development Co., and general manager of its subsidiary companies the Reupen Molybdenum Mines, of Eastern Ontario, and the Julian Alaska Gold Mines.

Samuel S. Webber, Trenton, N. J., has resigned his position as chief engineer of the Trenton plant of the American Steel & Wire Co., and has gone to Charlestown, N. H., to spend the summer. For a quarter of a century Mr. Webber was connected with the Trenton Iron Co. before it became a part of the American company.

OBITUARY

William Frazier, a prominent mining operator in Taos County, New Mexico, was shot and killed by John Birdwell, also a mining man, in self defence, on July 16. According to reports from Taos, a controversy arose between the men over a decision of the Supreme Court in which Frazier was declared only a third owner in the Frazier Group of mines at Twining, and upon which negotiations were under way for a sale to Boston parties at $7800. It is alleged that Frazier vowed he would kill Birdwell if he came upon the property, and when he appeared there a dispute ensued, in which shots were fired by the men simultaneously, Frazier falling dead. Both men are well known in the Taos County mining districts, having financial connections in Boston and New York.

J. Weidman Murray, aged 60 years, for many years connected with the iron and steel trade at Pittsburgh, died July 16 at his home in that city. Mr. Murray was born at Lebanon, Penn., and went to Pittsburgh in 1876 to become associated with the old Keystone Bridge Works. Subsequently he became identified with the Weimer Machine Works, Lebanon, and later moved to Birmingham, Ala., to become mechanical engineer for the Tennessee Coal, Iron & R.R. Co. Mr. Murray returned to Pittsburgh 19 years ago to become manager for the E. P. Allis Co., and continued in the capacity of Pittsburgh representative upon consolidation of the Allis-Chalmers Co. He was a member of the Dusquesne Club, the American Iron & Steel Institute, the American Society of Mechanical Engineers and the Engineers' Society of Western Pennsylvania.

Rev. Horace Carter Hovey died at Newburyport, Mass., July 27, aged 81 years. He was born in Indiana and educated at Wabash College. He served for a number of years as a Presbyterian minister, being at the same time an assiduous student of geology. In 1900 he resigned his pastorate at Newburyport to devote the remaining years of his life to scientific work and geology. He lectured on geology in many of the cities and colleges of the East. Dr. Hovey was a Fellow of the American Association for the Advancement of Science, the Geological Society of America, the International Geological Congress, the National Geological Society, and the Société Geologique of France. Dr. Hovey wrote extensively on geological subjects and published several books on caves, which were his specialty. Among his best-known works are several on the Mammoth Cave. He also wrote the articles on caverns in a number of editions of the "Encyclopedia Britannica." Edmund Otis Hovey, curator of the Department of Geology of the American Museum of Natural History, New York, is his son.

Dr. John Galbraith, dean of the Faculty of Applied Science and Engineering in Toronto University, and one of the foremost scientists and educators in Canada, died suddenly from heart failure on July 22, at his summer residence, Go-Home Bay, in the Georgian Bay district of Ontario. He was born in Montreal in 1846 and graduated at Toronto University in 1868. After graduating he engaged in railroad work, and in 1878 became professor of engineering in the Ontario School of Practical Science, of which he was appointed principal. In the early days of that institution Dean Galbraith taught all the branches of engineering himself, and in the face of great difficulties succeeded in building up the school to the position it at present occupies. When it became affiliated with the university, Dr. Galbraith was appointed Dean of the Faculty of Applied Science. He was one of the three commissioners appointed to investigate the collapse of the Quebec Bridge, a work which occupied some 10 months. The report of the investigation is now used as a text book in the university. Dr. Galbraith was one of the founders of the Canadian Society of Civil Engineers, and in 1909 was elected president of that body. Among other honorary positions which he held were the vice-presidency of the Engineering Section of the British Association for the Advancement of Science, and the vice-presidency of the Engineering Section of the American Association for the Advancement of Science. A striking tribute paid to Dr. Galbraith's work in promoting scientific education was the dinner tendered to him in Toronto last December, in celebration of the 35th anniversary of the School of Practical Science, which was attended by over 500 guests, including prominent engineers from all over the Continent. Dr. Galbraith leaves a widow, two sons and a daughter.

SOCIETIES

American Peat Society—The eighth annual meeting will be held at Duluth, Minn., Aug. 20-22. A number of valuable papers on the peat industry are promised, and there will be an excursion to the peat areas to the north and west of Duluth. Julius Bardollo, Kingsbridge, New York City, is secretary of the society.

American Institute of Mining Engineers—The Iron & Steel Committee has appointed a special Subcommittee on Iron Ore, the members of which are Dwight E. Woodbridge, chairman; John Birkinbine; Chas F. Rand; William Kelly; B. W. Vallat; F. A. Vogel; E. F. Burchard.

The summer meeting of the Pennsylvania Anthracite Section was held following an informal dinner at the Pottsville Club, Penn., Saturday, July 25, William G. Whildin, mining superintendent, Lehigh Coal & Navigation Co., was to present a paper on "Steep Pitch Mining of Thick Veins." Informal discussion of the paper followed.

American Petroleum Society—This society was organized at Pittsburgh, Sept. 10, 1913, at a meeting of secretaries of 30 local societies. Its object is to secure the unification and coöperation of these different societies; to aid the refiner and dealer, in the everyday course of business by getting a standard instrument for each test used on petroleum and its products and a standard method for using it; to aid the producer of petroleum through the investigation and working out of practical methods for decreasing the hazard of locating wells, decreasing the cost of drilling them and increasing their output. The society aims, with the assistance of its members, to be representative of all the divisions and phases of the petroleum industry and to select standards out of the multitude of tests and instruments now used, and to institute and direct a scientific investigation of all the problems that now or in the future may confront the industry. The officers

are: President, C. D. Chamberlin, Cleveland, Ohio; vice-president, Robert Galbreath, Tulsa, Oklahoma; Secretary, Irving C. Allen; U. S. Bureau of Mines, San Francisco, Treasurer, Warren C. Platt, Cleveland, Ohio. The first annual meeting will be held Oct. 15, 1914, in New Orleans.

INDUSTRIAL NEWS

Thurlow Steel & Forging Co., Chester, Penn., announces that its new plant is now in operation, under the management of John I. Rogers and Daniel C. Eagan.

John L. Malm, of the Malm-Wolf Co., Denver, Colo., is installing a dry chlorination plant for the Bunker Hill & Sullivan Co., to treat ore by the Malm process.

The General Electric Co. reports that an order was received from the Hercules Mining Co., Burke, Idaho, for two eighton, 30-in. gage, 500-volt electric mining locomotives.

The Chicago Branch of Keuffel & Esser Co., of N. Y., has now completed its removal to its new quarters, in the seven-story K. & E. Building, 516-518-520 South Dearborn St., Chicago.

The Anaconda Copper Mining Co. of Butte, Mont., has awarded the contract to the Redwood Manufacturers Co. of San Francisco for 15 redwood slime-treatment tanks 50 ft. diameter by 14 ft. stave.

Joseph T. Ryerson & Son, Manufacturers and dealers in iron, steel and machinery, of Chicago, Ill., announce the opening of a new warehouse in St. Louis, having taken over the W. G. Hagar Iron Co.

The Hardinge Conical Mill Co., of 50 Church St., New York, has just received a fifth repeat order from the Braden Copper Co., of Rancagua, Chile, for six Hardinge mills. These mills are all 8 ft. dia. by 48 in. cylinder and are to be driven by single reduction herringbone gears of the Wuest type.

The American Manganese Manufacturing Co., of Philadelphia, has taken over the properties of the Dunbar Furnace Co. at Dunbar, Penn., with those of the Dunbar Coal & Coke Co., and other subsidiary concerns. The company also owns the Cuyuna Mille-Lacs Iron Co., with mines of manganiferous iron ore on the Cuyuna range in Minnesota.

The Pacific Coast Steel Co. has made the final payment of $50,000 on the steel plant at Irondale, Wash., to the Metropolitan Trust Co., which took the plant over from the Western Steel Corporation. The new company has started repairing of the dock and is making other preparations to operate the plant. With the purchase the company gets several thousand tons of pig iron imported from China, which is now stored in the yards. The entire plant will be moved to Seattle and operated by the Pacific Company at Youngstown as an addition to the company's plant. A mortgage has been made to the Occidental Steel Co. covering the property, and a deed from the Occidental Steel Co. to the Pacific Coast Steel Co. has been filed. The purchase price is reported as $300,000. The Irondale plant has a capacity of 150 tons of pig iron daily.

TRADE CATALOGS

Sullivan Machinery Co., Chicago, Ill. Bull. 68A. The Sullivan Channeler in Engineering Work. 16 pp. 9x6 inches.

The Cement-Gun Co., Inc., New York, N. Y., catalog. The Cement-Gun. By Arthur E. Lee. 108 pp., illus., 9x6 inches.

American Concentrator Co., Springfield, Ohio, Bulletin No. 2. Coal and ore testing laboratory. 4 pp., illus., 6x9 inches.

The Kelly Filter Press Co., Salt Lake City, Utah. Bulletin; Kelly Filter Press in Dry Concentrates and Filtering acid solution.

The Brown Hoisting Machinery Co., Cleveland, Ohio. Catalog S. Brownhoist suspended concrete bins. 40 pp., illus., 6x9 inches.

The Harris Patents Co. 200 Fifth Ave., New York, N. Y., Bulletin AE. The Harris Valveless Engine Diesel Principle. 4 pp. Illus. 8½x11 inches, Bull. AC. 14 pp. Illus, 8½x- inches.

Smooth-On Mfg. Co., 572-4 Communipaw Ave., Jersey City, N. J. Instruction Book No. 7. Smooth-On iron cement. 64 pp., illus., 4½x6½ inches. This catalog will be sent free to all who apply for it.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c each.

BESSEMERIZING COPPER MATTE. James B. Herreshoff, Jr., New York, N. Y., assignor, to Nichols Copper Co., New York, N. Y. (U. S. No. 1,103,925; July 14, 1914.)

BLAST FURNACES—Cooling System for Blast Furnaces. John Hugh Means, Mayville, Wis. (U. S. No. 1,102,281; July 7, 1914.)

CHARGE CAR. John E. Greenawalt, Denver, Colo. (U. S. No. 1,104,491; July 21, 1914.)

CHARGING LADLE. Daniel Brennan, Woodlawn, Penn. (U. S. No. 1,102,236; July 7, 1914.)

CLASSIFIER—Hydraulic Classifier. Morris Paul Kirk, Salt Lake City, Utah, assignor of one-half to John H. Leavell, Salt Lake City, Utah. (U. S. No. 1,102,672; July 7, 1914.)

CONCENTRATING TABLE. William A. Huelsdonk, Le Grand, Calif. (U. S. No. 1,104,300; July 21, 1914.)

CONCENTRATION—Ore Concentrating Apparatus. John M. Callow, Salt Lake City, Utah, assignor to Metals Recovery Co., Augusta, Me. (U. S. No. 1,104,755; July 21, 1914.)

CYANIDING—Filter for Slimes Pulp and the Like. George Ridgway, Kalgoorlie, Western Australia. (U. S. No. 1,103,080; July 14, 1914.)

DISTRIBUTOR FOR CONCENTRATOR. William A. Huelsdonk, Le Grand, Calif. (U. S. No. 1,104,299; July 21, 1914.)

DRILLING—Chuck-Retaining Device. George H. Gilman, Claremont, N. H., assignor, by mesne assignments, to Sullivan Machinery Co., Boston, Mass. (U. S. No. 1,103,009; July 7, 1914.)

FLOTATION PROCESS—Ore Concentration. George Albert Chapman and Stanley Tucker, London, England, assignors to Minerals Separation, Ltd., London, England. (U. S. No. 1,102,873 and 1,102,874; July 7, 1914.)

FURNACE—Metallurgical Furnace. John E. Greenawalt, Denver, Colo. (U. S. No. 1,103,196; July 14, 1914.)

GOLD AND SILVER ORES—Recovery of Gold and Silver from Refractory Ores. Charles Butters, London, England. (U. S. No. 1,103,346; July 14, 1914.)

GOLD SAVING—Process for Saving Gold from Sand. Gerome H. Hamilton, Oregon City, Ore. (U. S. No. 1,104,112; July 21, 1914.)

HOISTING—Safety Apparatus for Mining Cages. Sidney William Richardson and William Staveley, Hokitika, New Zealand. (U. S. No. 1,103,841; July 14, 1914.)

LEACHING—Art of Extracting Copper. George B. Chittendedn, Chilito, Ariz. (U. S. No. 1,104,410; July 21, 1914.)

NICKEL—Extraction of Nickel from Mixtures of Nickel and Other Metals. Hans Edward Fierz, Basel, Switzerland. U. S. No. 1,103,747; July 14, 1914.)

ORE DUST—Process for Preparing Ore Dust for Smelting. William Cooper, Denver, Colo. (U. S. No. 1,103,400; July 14, 1914.)

ORE REDUCTION—Process of Reducing Ore to Metal. J. A. McLarty, Toronto, Can. (Brit. No. 16,277 of 1914.)

ORE TREATMENT—Process for Treatment of Minerals and Extracting Metal. Buenaventura Junquera, Oviedo, Spain. (U. S. No. 1,102,339; July 7, 1914.)

PROPS—Improvements in or Relating to Concrete Mining Props. F. Ruckrich, Frankfurt, Germany. (Brit. No. 3920 of 1914.)

ROASTING—Feeding Device for Roasting Furnaces. Harry H. Stout, New York, N. Y., assignor to General Chemical Co., New York, N. Y. (U. S. No. 1,102,454; July 7, 1914.)

ROASTING AND SINTERING ORES, Apparatus for. Arthur S. Dwight, New York, N. Y., assignor, by mesne assignments, to Dwight & Lloyd Metallurgical Co. (U. S. No. 1,102,982; July 7, 1914.)

ROASTING FURNACE. Knut Jakob Beskow and Arthur Ramén, Helsingborg, Sweden. (U. S. No. 1,104,288; July 21, 1914.)

SCREEN. Earl Adam Wood, Gem, Idaho. (U. S. No. 1,103,167; July 14, 1914.)

SEPARATION—Means for Separating Ores. Charles L. Hoge, Carterville, Mo. (U. S. No. 1,104,117; July 21, 1914.)

SIGNALING SYSTEM for Mines and the Like. George Thomas Plumb, Johannesburg, Transvaal. (U. S. No. 1,102,951; July 7, 1914.)

SINTERING—Process for Sintering Smelting Products and the Like. Josef Savelsberg, Papenburg-on-the-Ems, Germany. (U. S. No. 1,103,318; July 14, 1914.)

SLAG-DISINTEGRATING APPARATUS. Lars Larson, Chicago, Ill. (U. S. No. 1,103,886; July 14, 1914.)

SMELTING FUMES—Process of Rendering Smelter Fumes Useful and Recovery of Their Values. Charles S. Vadner, SCalt Lake City, Utah. (U. S. No. 1,103,165; July 14, 1914.)

SULPHIDE ORES—Improvements in or Relating to the Separation of Metallic Sulphide Ores. F. J. Lyster, Broken Hill, N. S. W. (Brit. No. 11,939 of 1913.)

SULPHUR—Process of Recovering Sulphur in Elementary Form from Pyrite. Gilbert Rigg, Palmerton, Penn., assignor to New Jersey Zinc Co., New York, N. Y. (U. S. No. 1,103,081 July 14, 1914.)

TIN—Improvements in or Relating to the Treatment of Tin Ores. J. B. Macdonald, Pazna, Bolivia. (Brit. No. 12,267 of 1913.)

ZINC BLENDE—Process of Preparing Pyritiferous Zinc Blende for Magnetic Separation. Gilbert Rigg, Palmerton, Penn., assignor to New Jersey Zinc Co., New York, N. Y. (U. S. No. 1,103,082; July 14, 1914.)

Editorial Correspondence

SAN FRANCISCO—July 22

The Suits Against Whitman Symmes, the Mexican Mining Co. and its directors, brought some time ago by Coffin, Berghauser and Moise, were formally dismissed on July 17. The Mexican Mining Co. pays $7500, not as a judgment, but as a condition of settlement. It is announced that the Mexican Mining Co. and the Union Consolidated Mining Co. will join the Comstock Pumping Association at once. Superintendent Symmes will return to Virginia City and resume work on the lower levels of the Mexican, and also begin work on the Union.

The New State Highway Through Shasta County, from Redding north will follow the old California and Oregon wagon road to Antler by way of Baird instead of by way of Kennett. The reason given by the highway commission for cutting off the smelting town is that a saving of $125,000 will be made. Baird, furthermore, being a mineral springs resort, is more attractive to automobile tourists than Kennett, which is the center of the copper-mining industry on the west side of the Sacramento River. The ignoring of the claims of Kennett is in keeping with the policy of the commission, which has given little attention to the needs of the mining sections in routing the new highways. The only routings of direct benefit to the mining sections are those which could not be avoided. It need not be charged that the highway commission purposely ignores the demands of the mining industry, but it is apparent that the wishes of the automobile travelers have been largely responsible for the routings of the highways. Shasta County has for many years been in the habit of taking the worst of it; and the habit seems to grow. The routing of the highway through Shasta County by way of Kennett would be of great commercial advantage to Redding, the county seat and the chief town between Red Bluff and Dunsmuir. Such a route would also include the copper camps of Keswick and Coram. With the resumption of smelting at Coram and with the concentrating of copper ores at Keswick, the west side districts will swing back into their old stride and in time it will be necessary for Shasta County to build such a road as should now be built with the bonds that the county has subscribed to the state highway funds.

DENVER—July 23

Another Chapter in the Long Fight Against Highgrading in the Cripple Creek district was to be opened July 20, when attorneys for the mine owners association were to file application in the district court for an injunction restraining 21 assayers from doing business in the district. The petition alleges that these men are responsible for "the encouragement of highgrading" and that most of them could not possibly exist on the legitimate proceeds of the business. The petition also alleges that the defendants are operating a "systematic fence" for the purchase of stolen high-grade ore and that the loss to the mine owners of the district is upward of $500,000 a year.

Sessions of the Western Federation of Miners' twenty-first executive convention were held in Denver during the week of July 19. The attendance was not large, probably not exceeding 200 delegates. State Auditor Roady Kenehan delivered the main address of welcome, including in his remarks a tirade on capital's warfare against labor and charging Governor Ammons with being out of sympathy with the labor movement and with being responsible for the state's purchase of "horses to ride down labor men." Otto Thum, Denver's commissioner of property, and President John McLennan, of the Colorado district of the United Mine Workers of America, also made addresses of welcome to the visiting delegates. The real figure of the convention was Charles H. Moyer, president of the Western Federation. His long biennial report was concerned chiefly with the suggestation of amalgamating the Federation with the United Mine Workers and with denunciation of the seceding faction at Butte. He blamed the loss of the strike at Bingham Cañon to the refusal of the members of the Brotherhood of Locomotive Engineers to leave their engines. He urged a Federal law establishing the rights of laborers to organize, and another law penalizing corporations that compel surrender of membership in labor organizations as a prerequisite to employment; he requested state legislatures to pass stringent measures controlling the dust nuisance in mines, and preventing the blacklist and association-card practices; he indorsed William B. Wilson, secretary of labor; he advocated coöperation with the U. S. Bureau of Mines, especially along lines of safety work; he proposed that mining students be taught the principles of unionism so that they may become understanding mine managers or superintendents. James Lord, president of the mining department of the American Federation of Labor, spoke on conditions in the southern Colorado coal districts and in Butte. A communication was received from the Webb City local union requesting aid in organizing that district. President Hoage, of the Denver Trades and Labor Association, reported that his organization had received a letter from the seceding members at Butte, and added that his "members could not rise to their feet fast enough to vote to throw the communication in the waste basket."

BUTTE—July 23

The Bullwhacker Copper Co. is threatened with receivership proceedings by some minority shareholders, who say they cannot understand why the company is losing money on its operations while a set of lessees who worked the property for a year or two made a lot of money. The property was shut down about 10 days ago, and it was announced that "it was unavoidable from the fact that a point in development and blocking out of ore has been reached where more machinery is absolutely necessary." Announcement of the possible receivership proceeding was made on the local stock exchange, and it was disclosed that Patrick Clark, of Spokane, president and one of the largest shareholders of the company, has advanced more than $100,000 to the company for building the mill and the present leaching plant, which had been officially credited with being a success. On the strength of this report and the profitable operations by former lessees, owners of mineral ground in that section of the district have been holding their claims at fabulous prices. It has been claimed that Bullwhacker copper was produced at a cost of 6 to 10c. A shipment of 52,000 lb. of Bullwhacker copper, 99.95% pure, has been made to Germany.

The Butte Mine Workers' Union—At a meeting July 20, William O'Brien and Mucky McDonald, the temporary president, were placed in nomination for president, to be voted upon Aug. 10. At the mass meeting held Sunday, July 19, a constitution and bylaws were adopted. The constitution provides that the election of officers shall be by voting machines. Each nominee for any salaried position shall have the privilege of selecting his own judge and clerk at the last meeting for nominations, but in no case shall there be more than 14 judges and clerks. The Butte Typographical Union, which offered to bring about an arbitration of the differences among the miners' organizations, was advised that the new union appreciated its good offices, but that it could not accept the offer, as there was nothing to arbitrate. At the mass meeting various clauses of the new constitution and bylaws were warmly discussed. Foremost among them was the question as to whether or not the new union should enter into any contract with the employing companies. It was suggested that the contract between the Anaconda company and the old union, which expires June, 1915, should be repudiated as having been entered into in violation of the bylaws of the old union. Other suggestions were to the effect that the contract should be lived up to. Finally, it was agreed that the bylaws of the new union should declare against any contract being entered into in the future with employing companies or individuals.

Senator Clark Instituted Suit in the Federal Court in Butte last week against the Butte & Superior for an injunction and accounting, after a two years' attempt to settle out of court. Senator Clark, or, rather, two of his companies, the Clark-Montana Realty Co. and the Elm Orlu Mining Co., are owner and lessee of the Elm Orlu mine, a property lying south of and adjoining the western portion of the Black Rock mine of the Butte & Superior Co., both claims being located on the Rainbow lode. According to the contentions of Senator Clark's engineers the vein has a dip to the north, and in its descent into the earth enters the Butte & Superior ground, and the latter company has been mining on that portion that lies within a vertical plane of

the Elm Orlu east and west end-lines. When the question of ownership first arose, the opposing interests got together and agreed to let the controversy be settled by a group of engineers. These have been at work on the problem for two years. From time to time there have been rumors as to what the engineers were finding, these rumors usually being that the contention of Senator Clark was correct, but a few weeks ago head officers of the Butte & Superior and Senator Clark met with their engineers in Butte, for, as was stated, a final settlement on the report and the recommendations of the engineers. After a few days the conference dissolved; Senator Clark left for Europe and the Butte & Superior officers returned to the East. It was announced that terms and details of the settlement were not to be given out, but that the two companies would continue their amicable relations in a neighborly way. The injunction suit following a few days later therefore came as a surprise. Since the beginning of the controversy the disputed orebody has not been disturbed, the Butte & Superior company having confined its mining operations to the eastern portion of the property. Senator Clark's appearance as a plaintiff in a mining litigation is a novelty, as in many controversies extending over a period of years he has been on the defensive. [According to some reports this is merely a friendly suit, and according to others, the matter was settled finally out of court.—Editor.]

DULUTH—July 25

The Number of Men Employed this Year in the mines is estimated at less than one-half that of 1913, probably only one-third. The Virginia district has probably the largest proportion, due to the Oliver, company's employing a total of 1600 men there, of whom 1200 are at the Alpena mine, where removal of the ore is being pushed.

Pickands Mather & Co.'s "First Aid" Contest was to be held at Hibbing, July 25, teams to compete from each of that company's 12 mines on the range and the winning team to go to the similar contest held at Ishpeming, Mich., in August, under the auspices of the Lake Superior Mining Institute.

At Duluth about 2600 Cars of Ore Per Day are being received, 1600 of which come to the Great Northern and the balance to the Missabe docks. In addition, the Iron Range is handling 900 cars per day at its Two Harbors dock and from 100 to 150 cars per day from the Cuyuna range are being received at the Soo Line and Northern Pacific docks in Superior.

The Tod-Stambaugh Co. is negotiating for a lease on the Great Northern Ore Company's Dean mine, which indicates that the policy of the latter company, after the option of its lease to the Steel Corporation, will be to lease its properties to other operators as well as to operate some itself through its mining subsidiary, the Arthur Iron Mining Co. It is not anticipated locally that the Great Northern operations will effect any material change in the open ore market after the withdrawal of the Steel Corporation, Jan. 1, 1915.

It Is Stated that the Oliver Iron Mining Co. will soon request bids for stripping the South Agnew Mine, at Hibbing. All survey and preliminary work has been done at the property. On the several tracts of land known as the Higgins Estate properties, near Gilbert and McKinley, the Oliver has developed two large orebodies, one estimated at 3,500,000 tons and the other incomplete as yet. The Oliver company buys the property on a basis of 10c. per ton for all developed ore, it having heretofore owned one-half interest in the fee with the Higgins Land Co. Part of the deposit can be stripped.

Realizing that any Change in the Labor Situation is unlikely for the remainder of the season, the migration to the wheat fields of Dakota has set in somewhat earlier than heretofore, much to the relief of the Mesabi Range authorities, and 400 to 500 men daily are leaving Duluth, westward-bound. A peculiarity of the present slack period is the fact that the 1913 scale of wages has been generally maintained, although slight cuts have been made in some instances. In fact, the demand for cheap labor, at $2 to $2.50 per day, exceeds the supply, due to the fact that the men prefer to await the high wages paid in the wheat belt after August 1.

Steel Corporation Is Opening Ten New Properties preparatory to maintaining its Mesabi production after the first of next year, when the lease of the Hill ore lands expires. One of these, the Leonidas, near Eveleth, will be the biggest underground mine yet developed on the Mesabi range. It has been estimated that the orebody contains close to 20,000,000 tons. Mining will be from a steel and concrete shaft, 400 ft. deep. Other large underground properties will be the Duncan, at Chisholm, and the Philbin, near Hibbing. The Steel Corporation's new mines also will include the Minnewas, Sullivan, Wanless and Prindell, in the Virginia district; the Vivian and Graham, near Biwabik, and the Dean, near Buhl. The various properties opened in the Hill lands will, after Jan. 1 next, be operated by the Arthur Mining Co., a Great Northern subsidiary. This company already is developing mines in tracts surrendered by the Steel Corporation heretofore, and by the opening of the season of 1915 it will be prepared to produce extensively not only from the workings now under Steel Corporation control, but from deposits it is itself making available. Considerable shipments will be made the present year, in fact. Some of the Arthur company's properties are the Hill Annex, Smith and Dunwoody.

A Resumé of Work on the Cuyuna shows that but three mines are shipping their production, the Kennedy, Armour No. 2 and Cuyuna-Mille Lacs. It was announced that the Rowe pit and the Ironton shaft would begin shipping by July 1. The Pennington and Thompson pits are still idle, as are also the Armour No. 1 and Meacham shafts. No announcements of activity at these properties have been made. The above lists all the North range producers. Of those companies not yet at the producing stage, the Duluth-Brainerd Iron Co. is now drifting on the 150 level to the ore, a distance not exceeding 100 ft. The new "Croft" shaft at Crosby has been located. A temporary shaft will be put down 400 ft. north of the main shaft, to be later converted into a timber shaft. The Northern Pacific Ry. will serve this operation, but as the Soo Line crosses the property it is likely that Soo Line tracks will be used. Jones & Laughlin are still drilling on the Feigh lands, adjoining the Pennington pit. Their option expires soon and they will no doubt lease the property, as there is a large tonnage in it.

On the South range the Wilcox shaft is nearing ore. Preparations were made at this shaft for a struggle with quicksand immediately above the orebody, as the drill samples had indicated the presence of quicksand. In sinking, however, only a mixture of sand and clay, mostly the latter, has been encountered. The inference is that in the churn drilling practically all the clay was churned out with the water, leaving only the heavier particles of fine sand to come up in the samples. The Brainerd-Cuyuna shaft, in the city of Brainerd, is sinking steadily, although a considerable volume of water has been encountered. The Barrows mine is not producing, although the pumps are kept at work. No announcement has been made as to the future of this South range pioneer, recently relinquished by M. A. Hanna & Co. The Adams shaft continues to stockpile its daily production, having now on hand probably 5000 tons. Much interest is being displayed in the district in regard to the proposed electric car line from Minneapolis to Brainerd via Anoka, St. Francis, Ogilvie, Onamia and the Mille Lacs lake country, thereby opening a large area of possible mineral-bearing land tributary to Brainerd.

IRON MOUNTAIN, MICH.—July 24

In the Felch Mountain District, northeast of Iron Mountain, principal point of the Menominee range proper, George A. St. Clair, of Duluth, and associates have undertaken exploratory work. Two diamond drills are employed. Little had been done in the locality for years. The present work is in the vicinity of the Calumet mine, a Pickands-Mather property, which has been idle for several years. Iron Mountain has been exceedingly quiet for several years so far as exploration or new development is concerned.

IRONWOOD, MICH.—July 25

The Wakefield Mine is a new shipper in the Lake Superior region. This property of M. A. Hanna & Co. lies south of the village of Wakefield, on the Gobegic range. It is an openpit, the ore mined by steam shovel. The deposit was discovered by Senden Rose, geologist and mining engineer, of Marquette, who was attracted by the formation; although the tract is well south of any mine previously developed in the Wakefield district, he decided to conduct exploratory work. An option for a lease was procured from the Keweenaw Association, of Boston, owner of the fee, and a drill was put into operation. Ore of excellent grade was encountered at slight depths below the surface, ranging from 30 to 70 ft. Subsequently it was determined the deposit was of large proportions. The option was exercised, and, in turn, the lease was transferred to the Hanna company on a royalty basis. The work of development was started last year. A large area has been stripped and production is now in progress. This is the first real steam-shovel mine in Michigan. The Balkan at Alpha near Crystal Falls will be the second of these.

The Mining News

ALASKA

ALASKA TREADWELL (Juneau)—Two mills handled 79,254 tons in June, producing $214,450 total gold.

ARIZONA

Cochise County

BLACK DIAMOND (Gleeson)—Phelps-Dodge company reported to have taken bond and lease on old Black Diamond mine. Estimated several thousand tons of ore on dumps that can be treated at Douglas profitably. Ores carry 2½% copper and about 7 oz. silver.

TOMBSTONE CONSOLIDATED (Tombstone)—Phelps-Dodge taken over control by securing at foreclosure sale for $500,000. Previously had acquired practically all claims against company, including notes of $1,500,000 face value. Unconfirmed report that Phelps-Dodge will install great pumping plant next spring; probably will not. Old company demonstrated that property had one of the largest inexhaustible reservoirs of water known in mining; popular superstition that direct connection with Pacific Ocean exists. At one time 10,000,000 gal. per day was pumped.

Gila County

WARRIOR (Miami)—Shipping about 100 tons 6% copper ore El Paso daily. Considerable development being done at property. Probable shipments will be materially increased if copper reaches stronger price.

GILA CANYON COPPER (Christmas)—Star churn drills being brought in to develop ground. Property shipped considerable ore in past from shallow workings. Intention of management to prospect ground thoroughly with drills in next 12 months.

CHRISTMAS (Christmas)—Reported mine to be sold at receiver's sale in near future. Property is owned by Development Company of America, which purchased from Saddle Mountain Mining Co. After paying off debts new company expended about $275,000 in development work and produced in 1907, 1,751,264 lb. copper, besides some gold and silver. Mine developed to depth of 850 ft., with about 16,000 ft. of work, which opened up ore estimated by management at 400,000 tons.

ARIZONA COMMERCIAL (Globe)—Drift being driven on 1200 level to connect with Old Dominion's Gray mine at same level. Now nearly 400 ft. in; less than 1500 ft. remains to be driven. Drift being driven from Gray side to meet it. Superintendent Boyd expects connection next October. Drift will drain Arizona Commercial; may be used to haul ore to Old Dominion. No stoping will be done until connection is made; all ore now shipped is produced by development work. Development continues to reveal greater reserves good commercial ore.

IRON CAP (Globe)—Because present low price copper, Iron Cap devoting more time to development; slightly reduced force. Last month shipped only 14 cars ore El Paso; this month probably will fall below that figure. No overhead expense, such as pumping, and management thinks better policy to keep shipments down until copper reaches stronger price; for present will mine just enough to pay slightly in excess of expenses. Orebody on 800 opened for about 300 ft. eastward from shaft and development drift being driven west from shaft at distance of 160 ft. begins to show vein matter with heavy iron content and some copper. General Manager Woodward says expects soon to enter commercial ore in this drift. Iron Cap building wagon road from county road to property.

INSPIRATION CONSOLIDATED (Miami)—Hoisting and compressor machinery being installed at rapid rate. One Nordberg compressor of 3000-cu.ft. capacity already in operation and another, Ingersoll-Rand, now being set up. This machine will compress 1325 cu.ft. free air per min. to 1000 lb. for underground haulage. All these machines are cross-compound, two-stage, with driving motor between. Synchronous motors used to insure as far as possible drive of uniform speed. C. V. A. Reed, in charge of erection of Nordberg compressor, now engaged assembling main hoist, also Nordberg. Work started on concreting 5,000,000-gal. reservoir. Entire reservoir to be concreted, reinforced with Clinton fabric. Presents unique problem in ferro-concrete construction, as sides are all sloping, with the two ends semicircular.

SUPERIOR & BOSTON (Globe)—Company shipping 70 tons copper ore El Paso daily, fines running about 5% and coarse ore from 9 to 10%. Orebody to east increasing in volume daily and Superintendent Tinker expects within another month to be shipping up to normal capacity of 100 tons daily. On 600, where vein was again encountered beyond the Quo Vadis fault, good ore now being stoped, and if conditions are similar to those farther west should be good body of ore there between 600 and 800 levels. For that reason 800 drift is being driven eastward to pick up orebody at the point where it was encountered on 600. Another 200 ft. must be cut before 800 drift reaches point sought; should be completed within six weeks. Face of east drift on 1000 level still about 75 ft. from Quo Vadis fault, being driven in footwall; no crosscutting will be done until fault is reached. If ore in any quantity is developed in eastern part of property another shaft will have to be sunk about 2000 ft. eastward from McGaw shaft. Company has installed hydraulic ram that is pumping back 150,000 gal. of the mine water daily into storage tanks at shaft, 85 ft. above. Another to lift water for various domestic purposes to point 250 ft. above will soon be installed.

Mohave County

SOUTHWESTERN COPPER (Yucca)—Timbers begun to arrive at station. As soon as they reach mine, sinking will be resumed on shaft.

GOLDEN GEM (Cerbat)—Mine being unwatered preparatory to extensive development work under direction O. F. Keuncer, Los Angeles.

COPPER GIANT (Hackberry)—Tests made on reground concentrates by Minerals Separation company show excellent possibilities. Reported that milling plant is to be erected soon. Coarse concentration will follow some usual method, only reground tailings being treated by flotation.

Pinal County

NEWBURY (Price)—Reported work will be resumed within next 30 days .Large amount of water to be pumped.

CALIFORNIA

Amador County

PLYMOUTH CONSOLIDATED (Plymouth)—New mill expected to go into commission in August.

CENTRAL EUREKA (Sutter Creek)—Twenty stamps dropping on good ore recently developed on lower levels. Shaft repaired and development in progress in addition to regular mining.

TREASURE (Amador City)—Ore of good grade disclosed in lower levels. Mine an old producer reopened about two years ago under management of E. S. McCurdy. Development carried on in spite of many obstacles. Indications are now that theory of persistence of veins at depth has been proved.

Butte County

OPHIR GOLD DREDGING CO. (Oroville)—Old Nevada dredge out of commission for some time has been robbed of large quantity of amalgam; man named Murphy arrested. Company intended to dismantle dredge and clean up sluices at same time.

Eldorado County

MONTEZUMA (Nashville)—Development in progress by representatives of Plymouth Consolidated Gold Mining Co., Ltd.

SHAW (El Dorado)—Electric power being installed. Current will be brought in over two-mile pole line from Western States Gas & Electric Co.

TREADWOOD SYNDICATE, LTD. (London)—A twelve-drill, two-stage air compressor and other equipment installed; arrangements made to open new ground in Oro Fino mine.

Imperial County

IMPERIAL VALLEY GYPSUM CO. (Holtville)—Preparation being made for installing plant to work gypsum deposit situated east of Holtville. Water being developed on premises.

Inyo County

WILSHIRE BISHOP CREEK (Bishop)—Mine unwatered in one week. Last year it required ten weeks. Difference in time due to improved methods. Development and ore extraction begun. Timbers being hauled for cyanide plant construction. All machinery is on ground, except tube mill at Bishop, ready for wagon haul.

LORETTA (Coaldale)—Main shaft down over 1600 ft., water encountered. Probable shaft will be sunk to 1700 ft. point before crosscutting. Schwab interests developing property and if operation follows development, 55-mile railroad to Coaldale will be necessary. If orebodies are proved and mine successfully operated this should make important copper-mining camp.

ST. IVES (Bishop)—Mark Matthews and others of Tonopah have secured two-year lease and purchase option on this mine in Chicago district. Stated 350 tons of ore on dump and 500 tons in sight underground. Shaft down 200 ft. and 5-ft. vein is said to carry medium-grade ore. Pipe line 1100 ft. long will be laid to bring water from spring; 7-ton Tetrault mill will be installed.

Lake County

UKIAH ASBESTOS MINING CO. (Ukiah)—New company organized to mine asbestos near Mendocino County line. Officers and directors are C. A. Miller, president; J. W. Wald, secretary; F. O. Taylor, treasurer; A. Beamer, general manager; T. L. Clark, director.

Modoc County

MODOC (Highgrade)—Three carloads ore ready for shipment. One to Selby, one to Kennett, one to Thompson; total shipment, 45 tons. This is for purpose of sampling and ascertaining best method of treatment. Ore is blocked out in mine. Vein is 7 ft. wide and shows good indications of persisting with depth. Order given for 25,000 bd.ft. lumber for construction of ore bins. If sampling and treatment of ore shipped warrant, reduction plant will be built on property. N. E. Guyot, manager.

Nevada County

RED LEDGE (Washington)—Mine bonded to New York men. W. F. Meeks directing preparations for development.

Property has been successfully operated on small scale with tunnels and small mill.

GOODWIN (You Bet)—Reported Anti-Debris Association will stop hydraulic mining, because of turning muddy water into Bear River. Town of Auburn gets water supply from Bear River.

Plumas County

CAMERON (Seneca)—This gravel mine bonded to Mr. Gilmer, Utah. Development on this property was first to tap channel on north fork of Feather River.

Shasta County

MOUNTAIN COPPER CO. (Keswick)—Installation of machinery in new concentrating plant in progress. Development in Hornet and Iron Mountain mines proceeding along normal lines. Large deposit of concentrating ore been developed in Iron Mountain.

REID (Redding)—Andrew Goodrich, foreman, and Joseph Garcia, miner, killed by blast at bottom of shaft July 17. Harvey J. Sallee, superintendent, escaped with injuries, though only 7 ft. up ladder when blast was fired. Bodies of Goodrich and Garcia torn to pieces. Men were lighting fuses of 17 holes and had difficulty in finding last fuse. No details of accident received.

Sierra County

BELLEVUE (Downieville)—Bellevue Mining Co. has commenced 3000-ft. tunnel from point in main tunnel of drift mine on Gibsonville ridge to tap channel higher in ridge and work ground near old Thistle shaft, where gravel was rich.

SIERRA-POORMAN (Downieville)—Winze at depth of 35 ft. just encountered 4½-ft. vein carrying high values in free gold and arsenical sulphides. Knobs of gold protrude from pieces of solid sulphide, while broken and decomposed parts of ledge pan gold freely. Mrs. H. T. Bragdon of Oakland is principal owner.

Siskiyou County

AIKEN (Oak Bar)—Profitable season closed and hydraulic elevating plant removed and installed at upper end of pit, ready for fall water-supply.

Trinity County

ASBESTOS CLAIMS located on east fork of Trinity River, near old mining town of Cinnabar, 18 miles northeast of Carrville, by Ben and Amos Johnson of Castella.

Tuolumne County

APP (Jamestown)—Five stamps put in commission. Principal work being done is cleaning up 60-stamp mill and retimbering collar of shaft. Alex. Chalmers of Lightner mine is managing property.

COLORADO

Custer County

HECTOR MINES DEVELOPMENT CO. (Westcliffe)—Company formed to take over Hector group adjoining old Bassick mine. Erection 50-ton cyanide plant to be started at once. Robert S. Billings, manager; J. F. Brazelton, assistant.

Park County

LONDON MINE—This property, opened in 1872, on London Mountain, seven miles west of the town of Alma, has now been absolutely idle for two years. For some years operations have been only spasmodic. In the minds of most persons who have not given special study to this mine, it is supposed to be in or along the London fault; but this is an error, as the London vein has apparently no genetic connection with the fault nor is it in the fault. The mine produced, for years, from a much faulted vein that was traced and stoped clear through the mountain. The theory propounded some time ago to the effect that oreshoots do not cross water courses appears to hold good in this case; for extensions of the London vein in both directions have been practically valueless. All mining heretofore has been through two main adits, one being driven from the north side of the mountain, the other from the south side and about 300 ft. lower. Development at greater depth is required before production can resume. It is feasible to drive a new adit much lower from the south side of the mountain but it would certainly be deadwork for a long distance. One scheme that has been proposed is to drive a crosscut from the eastern side of the mountainfi but this would be nearly a mile long in hard granite most of the distance. The last operations were conducted under a peculiar lease in which one-half interest was held by the owners of the property, the remainder by John M. Kuhn and John H. Singleton, of Alma, with Mr. Kuhn as superintendent. These operations were successful, from a financial standpoint, but they did not provide for continued activities since, during the life of the lease, no development was attempted. At present, therefore, the mine is worked out clean. Any sort of development now is prevented by lack of harmony among the owners—the Story, Jewett and Packard estates. It seems there are two factions with contrary notions concerning the conduct of this great group. Lessees will not undertake expensive methods of opening the mine at new depth nor will the owners.

San Miguel County

CLOUDBURST ABOVE TELLURIDE, July 27, resulted in flood which broke dam, partly wrecked 15 business blocks including 100 buildings, drowned two people and rendered 50 families homeless. Damage estimated at $300,000.

Teller County

THE RAINFALL IN JULY has been excessive, the heaviest on record in the district, over 9 in. Lower levels of many mines are accumulating surface water faster than it drains away; much inconvenience results.

DRAINAGE TUNNEL—Tracks finished to breast and timbering completed. Work of actual driving will commence at once.

ALTMAN WATER COMPANY—Property of this company which supplies most of larger mines and mills with water from pumping plant at Grassy sold to private interests. H. L. Shepherd, of Cripple Creek, is new manager.

District of Columbia

THE FRENCH BILL, validating phosphate locations, terms of which are given on p. 208, this issue, was passed on July 23, by House, and is now before Senate.

WORK IN NORTHERN MEXICO is not distinctly urged by State Department, but mine operators, questioning those interested in Mexican affairs find in them distinct disposition to recommend resumption of operations. Impression given to mine owners lately visiting department, that if they can arrange matters with General Villa to secure protection for themselves they will probably be in fairly satisfactory position to go ahead without being disturbed.

MICHIGAN

Iron

ASHLAND (Ironwood)—Working force at this property increased to 200 men and all ore mined will be shipped. Company has sold 225,000 tons for delivery this year.

BAKER (Iron River)—Corrigan, McKinney closed this mine on order from head office in Cleveland. About 200 men were employed; good deal of ore shipped this season; great deal still in stock.

NEWPORT (Ironwood)—About 150 men were added to underground force, bringing total up to about 1000. Large ore sales have been made and all ore in stock with daily hoist will be sent out this summer.

JONES & LAUGHLIN (Ishpeming)—Shaft which company is sinking at Iron Mountain Lake, three miles south of Ishpeming, is down 200 ft. and will have to go to 650 ft. Ore will be encountered at about 100 ft. from the shaft. Shaft is 10 ft. 4 in. by 12 ft. 4 in. inside timbers, concreted for 30 ft. below collar. Little water encountered thus far in spite of fact that shaft is within few feet of lake; no trouble is anticipated, as ground is tight. Only 6 ft. of sand on surface and shaft will be in rock entire distance. Company has 10 forties and expects to locate other orebodies in addition to ones found, by drilling. Several operating mines in this territory number of years ago but little done there in 20 years. Most of men to be laid off at Lake Angeline mine when that property is closed for good in December will be given employment at company's new property.

DAVIDSON (Iron River)—Important suit involving this newly-developed and valuable iron property under advisement in the circuit court for Iron County, Mich., Judge R. C. Flannigan presiding. Mine opened and being operated by Davidson Ore Co. There is involved in outcome, validity of lease under which this company has possession. Anzetin Mtynarezyk, Polish clergyman, formerly of Iron River and latterly of Ohio, is plaintiff. Defendants are Constancy, Zygmunt and Rosalie Zyskowski, Frank Jackson, Molly Erickson and Michael Gleason, all of Michigan. Suit is complicated piece of litigation; history may be summarized as follows: Mtynarezyk became owner of tract in May, 1891, by purchase from Edwin Honneywell, holder of the patent issued by the United States Government, and in August, 1895, he conveyed it to Constancy Zyskowski, reserving mineral rights. Plaintiff left region and in 1908 received from Zyskowski letter in which he was asked to quash reservation of mineral rights. He did so for $25. Some months previous Michael Gleason had procured an option to explore the land. Ore was encountered, and in October, 1908, Gleason assigned option to Gleason Exploration & Mining Co., of which he is large stockholder. Provided as condition of assignment that company should pay to Gleason 3c. per ton on all ore mined and shipped. Option exercised in February, 1909, when there formally was issued to company lease calling for payment of a royalty of 15c. per ton, of which Zyskowski family was to receive 12c., Frank Jackson 1½c. and Molly Erickson 1½c. Gleason company in turn gave to Frederick N. Beegle, trustee, representing Davidson Ore Co., an option providing for further exploration of tract. Second option was exercised in June, 1910, on which date there was issued to Trustee Beegle a lease, under terms of which there was to be paid to Gleason company $15,000 and royalty of 35c. per ton, together with the royalty of 15c. as previously set forth. Plaintiff asks that relinquishment of mineral rights be set aside, leases annulled and he be free to do with mining rights what he pleases; alleges relinquishment was procured through fraud, it having been represented that reservation constituted hindrance to sale and that no ore existed. Set forth in defence that Mtynarezyk never was real owner of land; acted only as agent in acquiring tract from Honneywell, and money with which purchase was made was furnished by Zyskowski. When Michigan mines were assessed for state tax commission by James R. Finlay, in 1911, Davidson was listed as containing two million tons of ore, shown by diamond drilling. No doubt deposit is materially larger than indicated by exploratory work. Mine well developed by Davidson company and provided with fine equipment. Is producing and shipping.

MINNESOTA

Cuyuna Range

THOMPSON (Crosby)—Openpit will begin shipments July 27, being second new Cuyuna Range pit to ship this year.

PENNINGTON (Crosby)—Shipments started recently. Required minimum of 100,000 tons will be shipped, from present outlook.

CROFT (Crosby)—Contracts for erection of dry, boiler house and other mine buildings, aggregating $25,000, let to W. B. Shaver, Virginia, Minn., work now under way.

IRON MOUNTAIN (Crosby)—Company has closed deal with Eastern interests which will take over its property with royalty advanced from 35c. to 75c. Advance payment of $50,000 said to be included. Ore is high in manganese.

DULUTH-BRAINERD (Crosby)—Ore encountered July 15 150 level, 120 ft. from shaft. Company states that drift samples thus far have overrun drill-hole samples materially. First two samples analyze 36.75% mananese, 22.91% iron and 40.38% manganese and 19.55% iron, being somewhat superior to average of Cuyuna-Mille Lacs high-grade manganiferous ores.

Mesabi Range

TWO BIG CENTRIFUGAL PUMPS are removing water from Carson Lake; water being pumped into ditch which conveys it to Kelly Lake. Lake level already lowered 8 ft. The head of the lake is underlain with large deposit of ore which could not be recovered unless water were pumped out. Lake has been used as dumping ground for waste sands for several years.

ARTHUR IRON MINING CO. (Coleraine) — Contract awarded to A. Guthrie & Co., St. Paul, Minn., for stripping property on western Mesabi, near Coleraine.

OSTERBERG & JOHNSON (Biwabik)—Large deposit ore found by diamond drills in Sect. 10, 100 ft. below surface. Drills are being moved to another part of property to prove up extent of deposit.

MINORCA (Virginia)—Pickands-Mather is dismantling No. 4 shaft. Tracks, machinery and all other equipment being removed and mine will be abandoned. Other shafts of property will continue to operate.

WEBB (Hibbing)—Mine flooded last week when heavy rainstorm passed over Mesabi range. Shaft and levels filled with water in a short time, pumps being unable to handle heavy flow. No effort being made to remove water and reported that mine will be idle balance of season.

INTERSTATE IRON CO. (Grand Rapids)—Dredge which this company has been operating to strip large piece of ore land on extreme western Mesabi has not proved success; will probably be abandoned. The "mud hen," as it was termed, worked all right in sand, but trouble came when boulders and stumps were encountered. At times entire day would be lost removing debris from pipe lines. Costs have been low in some kinds of ground, but extremely high in others. Dredge is not being worked now.

Vermilion Range

NORTH AMERICAN (Tower)—Sample shipment 25 tons made for chemical analysis and test; said to be copper quartz; expected by those interested to analyze as much at 11% copper. Included in shipment were 30 sacks from the "gold-graphite" vein. This is first public announcement that mine has encountered copper, although discovery of gold, iron and graphite has been heretofore noted.—[Another layer added to the famous pousse café.—Editor.]

MONTANA

Granite County

ROYAL BASIN MINING CO. (Maxville)—Electrification mine and mill equipment progressing steadily. Contract just let for construction of pipe line to bring waters of Boulder Creek to site of proposed power plant, about four miles from mines. Pipe line will be of wood-stave construction, 7 ft. in diameter and one mile long.

Silver Bow County

BUTTE & SUPERIOR COPPER CO. (Butte)—Monthly report covering operations of oil flotation plant during June was filed with clerk of court in compliance with order made last November in suit of Minerals Separation Co. According to report, 26,258 tons were treated by flotation at $3.75 per ton of concentrates produced. Latter were valued at $27.27 per ton, f.o.b. company's mill.

NETTIE (Butte)—Unwatering shaft of this property of the Anaconda company, two miles west of Butte, is proceeding rapidly, and is now down to 350-ft. level. Mine is 540 ft. deep. It is expected that this work will be completed in three months. Shaft will then be sunk and although geologically there is small possibility of obtaining commercial copper, it is believed that chances of opening zinc ore are good, as this has been the case, with depth, with other silver mines in Butte.

BUTTE MAIN RANGE (Butte)—Plans perfected to resume operations at properties of this company, closed down about 12 years ago. Claims are in the eastern portion of Butte district, cover area of 45 acres patented ground, including old Sinbad with shaft 716 ft. deep. Crosscutting will be started from 500-ft. level, followed by sinking or raising on any ore encountered. Recent development on adjoining properties of East Butte, Rainbow Development, Tropic and others having proved continuation of vein system of Anaconda hill toward eastern section of district, company feels justified in resuming operations and starting extensive development work, for which sum of $50,000 has been raised among chief owners. Work is in charge of Superintendent Pat Sheehan.

EAST BUTTE (Butte)—Compaign of expansion inaugurated by company since purchase of Pittsmont properties is watched with considerable interest, inasmuch as results in deeper levels will materially affect other mines depending on what lower levels show. This refers to properties such as Davis-Daly, Tuolumne, Pilot-Butte and others. Development work in East Butte now proceeding on 1500-ft. level, lowest point in mine, comparatively shallow depth for Butte. Hand in hand with underground development work, company has carried on extensive and costly improvements of surface plants which will permit doubling present output of 1,000,000 lb. per month as soon as the price of copper makes such increase profitable. Not likely question of dividends will be considered until $500,000 owned by company account of Pittsmont purchase is liquidated. June was record breaker in production, which amounted to 1,215,323 lb. In addition company produced 25,190 oz. silver and 287 oz. gold.

NEVADA

Churchill County

MERGER (Jessup)—Car of ore assaying $60 recently shipped Hazen sampler; 200-ft. shaft being sunk.

Clark County

BOSS GOLD MINING CO. (Goodsprings)—High-grade gold ore discovered in winze being sunk from upper Boss tunnel. Car of this assaying $350 per ton ready for shipment. Development work under way for several months and good tonnage gold and copper ores developed.

Elko County

ELKO PRINCE (Gold Circle)—Option reported as held by English company is really held by Goldfield Consolidated, according to statement of Albert Burch, general manager of that company.

NEVADA-BUNKER HILL MINING CO. (Bullion)—Crosscut tunnel being driven is in 2160 ft. Within next 300 ft. should cut Red Bird and Tripoli veins, from both of which good tonnage silver-lead ore has been produced. Air compressor ordered, will be used in driving tunnel. Four sets of lessees are working on company ground, three shipping ore to Salt Lake Valley smelting plants. This ore is hauled to Raines' siding, on Eureka R.R., 12 miles distant, by two auto trucks and by teams.

Esmeralda County

THREE MINERS IN GAS-FILLED SHAFT 20 miles northwest of Tonopah were reported July 21 as unlikely to be rescued alive. Shaft was 90 ft. deep, near Crow Springs. One miner escaped and summoned aid from Millers. Crew from Bureau of Mines rescue car went to assistance in automobile. Miners all Servians employed by Tonopah syndicate.

VERNAL MINING CO. (Goldfield)—A 1-ft. shoot high-grade ore struck in drift from winze below 100-ft. level. Drift on 200-ft. level will be extended to cut this shoot.

SILVER PICK CONSOLIDATED (Goldfield)—Satisfactory progress in development work. Two raises from 500-ft. level started and drifting toward Red Top property of Goldfield Consolidated under way.

JUMBO EXTENSION (Goldfield)—Due to increased percentage extraction made on ore being treated at Goldfield Consolidated mill, been found economical to mill there also ore formerly considered of shipping grade.

Humboldt County

A GOLD STRIKE ON COVE CREEK, in Pine Forest Range, has been made, it is reported. Gold found in both placer ground and quartz veins. Place 75 miles by auto from Jungo.

TRUITT MAY DAY NO. 2 (Haystack)—Lease granted on this property. Quartz vein, 15 in. wide, exposed on surface for length of 300 ft.; good pannings obtained along entire length.

MURRAY & AUSTIN (Haystack)—Two carloads ore being hauled to Jungo for shipment. Many lessees working in this district and considerable shipping-grade ore being mined from near surface.

HINES-BALDWIN (National)—Strike high-grade ore made on this property now worked by White Rock Leasing Co. Discovery made in raise from drift on Wheeler Tunnel level; shoot 6 ft. wide with 3-in. streak of high-grade ore.

Lincoln County

YUBA LEASING & DEVELOPMENT CO. (Pioche)—Stoping on 800-ft. level. Ore hoisted through No. 3 shaft and sorted on surface.

AMALGAMATED PIOCHE (Pioche)—Development work on newly discovered oreshoot on 1400-ft. level continues to open good grade ore containing silver, lead and zinc.

E. & F. MINING CO. (Pioche)—Stated work will be resumed in lower tunnel and shipments made from dumps. Property lies between Day-Bristol and Hillside, covers 240 acres.

Mineral County

ROCKLAND MINE (Rockland)—Consignment of 200 tons of machinery, lumber and general supplies arrived. Expected mining will commence in near future.

AURORA CONSOLIDATED (Aurora)—One 15-stamp unit of mill now running and test being made of cyanide equipment. If results are satisfactory, entire mill will probably be running within 30 days; if not, four months will be required to make necessary changes. Crew of 220 men now employed. Three-year contract made with Reading Mercantile & Transportation Co. to haul all freight from Hudson station to Aurora. Stated 30 cottages will be built by company for employees.

Nye County

TONOWA C. M. & M. CO. (Monte Cristo)—New tramway, mine to mill, completed; mill overhauled; 25 to 30 tons per day being treated.

MANHATTAN CONSOLIDATED (Manhattan)—Preparations being made to extract ore developed west of shaft. Track laid to Consolidated mill, 700 ft. distant, where ore will be treated.

RANDOLPH GOLD MINING CO. (Bonnie Clare)—Operations will be resumed Aug. 1, after four months' shutdown. North crosscut on 200-ft. level will be driven to cut downward extension of vein opened on 100-ft. level. Sinking on vein from 200- to 400-ft. level will then be done.

NEVADA CINNABAR CO. (Ione)—Installation of modern furnaces completed and plant is now producing eight flasks of mercury per day. Power supplied by 44-hp. gasoline engine which drives dynamo. Cost of new equipment said to be $180,000. Fifty tons ore per day being mined in glory-hole.

Storey County

SETTLEMENT OF DISSENSION between Mexican and Union companies arranged, according to statement of John Landers, vice-president of Mexican and president of Union, who says work will be resumed at once and sinking to 2500-ft. level done.

ALTA (Virginia City)—Shaft repaired from collar to 1600 level, and management contemplates taking up work there, where 5-ft. ledge uncovered carries low-grade ore.

UNION CONSOLIDATED (Virginia City)—Joint Union-Sierra Nevada winze will be pumped out below 2500 level, and at the 2350 crosscut extended to intercept vein.

SIERRA NEVADA (Virginia City)—Work will be resumed in mine in near future. Sample milling of 25 tons recently taken from the 2500 winze gave average value at mill of $38.

BELCHER (Virginia City)—Increasing value in quartz is reported from north drift on recently recovered 1600 level, and material now being recovered is shipped to Yellow Jacket mill for treatment.

MEXICAN (Virginia City)—Sinking pump placed in 2500 winze, which will be unwatered, winze sunk from the 146-ft. point for sump, and station cut out at 2650 level. Drifting north and south on vein will then be taken up.

CONSOLIDATED VIRGINIA (Virginia City)—Northeast drift on 2500 level on vein is following 17-in. streak of quartz running $10 per ton. Streak is on hanging-wall slip, and on west wall another quartz streak is showing.

YELLOW JACKET (Virginia City)—New cyanide plant recently installed at company's 200-ton concentrating plant is in operation, designed to treat six tons concentrates per day, the output of the mill. Process is same as used at Goldfield Consolidated mill. Tailings have no commercial value and are not treated.

NEW MEXICO

Grant County

U. S. CONTINENTAL MINES CO. (Tyrone)—Option taken on Uncle Sam and Free Coinage mines in Burro mountains by J H. Shockley, of New York City. Irvin K. Farrington Co., of New York, said to have charge of deal.

85 MINING CO. (Lordsburg)—Company received 450-hp. engine, delivered to mine by 36-horse team from Lordsburg. Ore contract of J. Olney purchased by B. B. Owenby and J. P. Freeman, who intend using tractor for ore transportation to Southern Pacific railroad.

Luna County

BI-METALLIC MINING & MILLING CO. (Deming)—Company reported to have made rich discovery on property in Sierra County.

GERMAN-AMERICAN MINING CO. (Columbus)—Carload of machinery arrived in Deming, consigned to company operating in Tres Hermanas mountains, 20 miles southwest of Deming and 10 miles northwest of Columbus. Ore carries lead and zinc.

Socorro County

NORTH GRAPHIC MINING CO. (Magdalena)—Suit filed against company by A. L. Grimshaw, A. C. Thomas and R. B. Thomas. Receiver asked for and injunction preventing company making any disbursements until claims of plaintiff are settled.

PENNSYLVANIA

GENERAL SMELTING CO. (Wyndmoor) — Judge Ryan heard argument today on bill in equity brought by George Burton and Frank P. Myers, to restrain company from smelting zinc and zinc ores. Complainants are owners of extensive greenhouses in Springfield, Myers testified he had $120,000 invested in rose bushes and shrubbery, says that fumes, gases, dust and smoke from smelting plant have killed many plants and trees and that many more are dying. Burton, who has $45,000 invested, gave similar testimony. Decision reserved.

SOUTH DAKOTA

Lawrence County

FOREST OFFICERS WILL BUILD ROADS with $5500 available for work, 10% of amount realized during last fiscal year from timber sales on Black Hills forest reserve. Portion of Deadwood-Denver trail, between Pactola and Sheridan, was recently severely damaged by cloudburst, and this will be repaired at once.

IRONSIDES (Squaw Creek)—Tunnel being driven alongside large porphyry dike, toward orebody exposed in former work.

GOLDEN REWARD (Deadwood)—Thorough tests to be made with continuous-decantation cyanide process, dispensing with filter, to that end tanks and thickener equipment being installed.

TROJAN (Trojan)—Gradients being eliminated on ore-haulage road, by what is practically reconstruction of line. Gasoline locomotives used. Expected that work under way will permit engines to handle double their present load.

HEIDELBERG (Two Bit)—Last shipment of ore to Golden Reward mill at Deadwood was settled for at $25.40 per ton. Property was recently examined by agents of state securities commission and state mine inspector, under "blue sky" law, preliminary to issuing permit to company to sell treasury stock to public.

NEW RELIANCE (Trojan)—Ingersoll-Rand air compressor and stoping drills installed. One drill, working in vertical orebody, is supplying nearly one-half mill capacity. Orebody averages 8 ft. wide, known to be more than 1000 ft. in length, backs average 100 ft. for that distance. Mill dropping full complement, 30 stamps.

TITANIC (Carbonate)—During past year company spent $20,000 in development of old Iron Hill property. Work included erecting shaft house, installing machinery, sinking 267 ft. of shaft and running 290 ft. of drifts and crosscuts. At present time two jackhamer drills being used in drifting. Decided to install diamond drill at bottom, 300 ft., and run number of holes in different directions.

Pennington County

DAKOTA CONTINENTAL COPPER (Hill City) — Work suspended; no statement made as to future plans. Since water was removed last January, large Rumsey triplex, electric-driven pump was installed on 700-ft. level; shaft deepened from 813 to 850 ft.; station cut at 825-ft. level and crosscut run on this level 240 ft. It passed through quartz vein barren of copper, and evidently not vein sought. All light machinery was removed from shaft, also motor of big pump; air lifts installed and everything put in such shape that resumption of work would be comparatively easy.

UTAH

Summit County

PARK CITY SHIPMENTS for week ended July 17 amounted to 2,930,860 lb. Largest shippers were Silver King Coalition, Silver King Consolidated, and Daly-Judge, in order named.

NEW CUSTOM MILLING CO., which has been remodeling old Grasselli zinc mill at Park City, has placed order for roaster with Knight-Christensen Metallurgical Co. Roaster will be of type used at Knight mill, Silver City. Ore being hauled from American Flag mine and stockpiled.

SILVER KING CONSOLIDATED (Park City)—Shipments of 30 to 40 tons and upward being made daily. Output from this property was second largest from camp for week ended July 17.

SNAKE CREEK TUNNEL (Park City)—Average daily progress during July, 13 ft., working two shifts. High record, 15 ft., including ditch, track, etc. Face of tunnel in limestone and considerable water developed.

SILVER KING COALITION (Park City)—Annual report issued, covering period of eight months to Dec. 31, 1913, fiscal year being changed to coincide with calendar year. Report shows that cost of excavating, reinforcing and concreting at new Silver Hill station was $46,796. Electrical machinery, compressor and installation cost $50,421, making total cost $97,191. Station is 8400 ft. from portal of Alliance tunnel and at depth of 1670 ft. below surface. Drifting started on 100-ft. level of Silver Hill shaft, and ore expected to be reached on this level. Shaft will be sunk to contact 1000 and 1200 ft. below tunnel, or approximately 2900 ft. beneath the surface. Ore known to occur along contact of limestone and quartzite east of here. Necessary to install heavy equipment so as to carry on work at depth.

WISCONSIN

FLORENCE IRON CO. (Florence)—Probably finest farm in Florence County belongs to this company, property of Ladenburg-Thalmann interests, of New York. Acreage is 400, of which 135 is cleared and in crops. Among live stock is flock of 375 sheep. Company's Bates mine, in Iron River district, has started shipments over the new Iron River extension of Chicago, Milwaukee & St. Paul. Milwaukee also hauling ore from Chicagon mine.

CANADA

Ontario

TRETHEWEY (Cobalt)—Company has dropped option on West Beaver silver mine near Port Arthur, Ont.

TECK-HUGHES (Kirkland Lake)—Interests controlling Nipissing have secured option to run for a year on enough of the stock of this mine to give controlling interest.

CASEY-COBALT (Cobalt)—Recent official reports not encouraging. Consulting engineer states unless new orebodies are discovered, coming year will show depletion of ore reserves.

PETERSON LAKE (Cobalt)—Judgment given in favor of Peterson Lake in action with McKinley-Darragh over staking of disputed territory. Costs assessed against McKinley-Darragh.

NORTH DOME (Porcupine)—On application of Timiskaming Mining Co., which is creditor to amount of about $85,000, court at Toronto has ordered this company to be wound up.

CART LAKE (Cobalt)—Company has shipped 7741 lb. high-grade ore running 2700 oz. per ton to Nipissing mill for treatment. Gould vein has been cut at 332 ft., where it has 1 to 1½ in. high-grade ore.

JUPITER (Porcupine)—Development work on 400-ft. level vigorously pushed by McKinley-Darragh under working option, but assays vary so greatly that mill run will be necessary as conclusive test of values. Winze is being put down to 500-ft. level.

TOUGH-OAKES (Swastika)—H. H. Johnson, consulting engineer, estimates average value of $32.60 over stoping width of between 4 and 5 ft. States that by Jan. 1 mine will have three years' ore developed for mill with capacity of 2500 tons per month, and estimated annual net profit will be $750,000. Orders being placed for machinery for new mill. Since commencement of operations, mine produced up to May 19 last, total of $220,000.

MEXICO

Jalisco

REVIVAL OF AMERICAN MINING in Jalisco seems more likely as result of assurances received by New York mine owners from Carranza. Gerard-Daly interests are quoted in New York as confident of early resumption of operations.

Sonora

CANANEA CONSOLIDATED (Cananea) — Oversight and Veta Grande mines reported as found on fire, July 24, Veta Grande was burning in several places, giving rise to belief that fire was incendiary. Company officials said they hoped to get blaze in that mine under control soon, but not much hope was held out for Oversight mine, with which it connects by tunnels. Copper Queen helmet crew was proceeding to mine because of first reports that several miners were entombed, but it developed later no one was endangered.

COLOMBIA

ANGLO-COLOMBIA DEVELOPMENT CO., LTD., (8 Old Jewry, London)—Equipment for company's new dredge, designed by Inder & Henderson, has been finished at Renfrew, Scotland, by Lobnitz & Co., Ltd. Dredge is to be erected near Novita on Condoto River where company has developed over 13,000,000 cu.yd. of gold-platinum-bearing gravel.

The Market Report

METAL MARKETS

NEW YORK—July 29

The metal markets have been weak, mainly on account of the collapse in the markets abroad, due to the war excitement. Home demand seems to be improving.

Copper, Tin, Lead and Zinc

Copper—The serious political disturbances in Europe have of course, had an immediate effect upon the copper market. Before war actually threatened, the market had been very quiet. Consumers abroad were covered for their nearby requirements and were disposed to hold off, and the same conditions prevailed in this country. The outbreak of the war between Austria and Servia bringing with it a financial crisis and a general desire on the part of European merchants to reduce their commitments to a minimum, practically stopped all buying over there. It also caused immediate pressure to sell, as a result of which prices for electrolytic copper quickly tumbled to 13c., delivered, 30 days. Sales at that price were made to domestic consumers on Monday. The crisis in Europe naturally kept European buyers out of the market. During the two days following, when the stock markets of the world were panicky, copper was practically unsalable. Electrolytic was offered by several agencies at 12⅞c., delivered, 30 days.

The average for the week of our prices of electrolytic copper was 12.904 cents.

The London market for standard copper has declined sharply. On Thursday, July 23, spot was £60; three months £60 8s. 9d. On Monday, July 27, spot was down to £58 15s.; three months £59 5s. On Wednesday, July 29, spot closed at £57 5s. and three months at £58 5s.

Base price of copper sheets was reduced ½c. on July 27 and is now 18½c. per lb. for hot rolled and 19½c. for cold rolled. The usual extras are charged and higher prices for small quantities. Copper wire is 14½@14¾c. per lb., carload lots at mill.

Exports of copper from New York for the week were 8903 long tons. Our special correspondent gives the exports from Baltimore at 3820 tons for the week.

Imports of copper into France six months ended June 30 were 49,263 tons, an increase of 6277 tons over last year.

Tin—The demoralization of all markets as a result of the disturbed political condition abroad also seriously affected this metal. On the London Metal Exchange prices broke badly, reaching their lowest point, equaling a decline of over £8, on July 27. Quotations in this market followed those established abroad, with the difference, however, that the extraordinarily high sterling exchange made quotations in this market appear rather high by comparison. However, there was no interest shown by consumers, and hardly any business transacted between dealers. The market closed somewhat better at £135 5s. for spot and £138 10s. for three months, and about 30⅞c. for July-August tin here.

Lead—The market has been weak, owing to the desire of many holders to liquidate their stocks. At the lower prices there was a fair amount of business, including some for future delivery.

The European lead market is also weaker, Spanish lead being quoted £18 15s.; English lead 15s. higher.

Exports from Baltimore for the week included 336,292 lb. lead to Germany; 778,687 lb. to Glasgow, Scotland; $784,750 lb. to Rotterdam, making 1,897,729 lb. lead in all.

Spelter—Early in the week there was a good demand and some considerable tonnages changed hands at around 4.85@4.90c., St. Louis. Later on, when the European disturbances occurred there was some pressure to sell, in consequence of which prices declined, round lots being offered by producers at 4.75c., St. Louis. The market at this time was confused, reports of offerings at all kinds of figures being current, a condition that was not unnatural in view of the situation in the stock market.

The London market for good ordinaries is unchanged at £21 15s.; specials £22 10s. per ton.

Base price of zinc sheets is $7 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—Business seems to be improving so far as sales are concerned, but there is sharp competition for the trade. Current quotations are 17.50@17.75c. per lb. for No. 1 ingots, New York; but there are reports that sales as low as 17.37½c. have been made.

Antimony—The market is a little brighter and business is moving more freely. Quotations are unchanged. Ordinary brands—Chinese, Hungarian, etc.—hold at 5.40@5.70c. per lb. For Cookson's, 7.10@7.30c. per lb. is asked, with 6.80@7c. for other special brands.

DAILY PRICES OF METALS

NEW YORK

July	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc	
			Electrolytic, Cts. per Lb.	Cts. per Lb.	New York, Cts. per Lb.	St. Louis Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Dts. per Lb.
23	4.8800	54¼	13.10 @13.15	31⅝	3.90	3.72½ @3.75	4.95 @5.00	4.80 @4.85
24	4.8815	53⅝	13.00 @13.10	31¼	3.90	3.72½ @3.75	5.00 @5.05	4.85 @4.90
25	4.8805	53⅛	12.90 @13.00	31¼	3.85 @3.90	3.70 @3.75	5.00 @5.05	4.85 @4.90
27	4.8875	52⅝	12.80 @12.90	30¼	3.85 @3.90	3.70 @3.75	4.95 @5.05	4.80 @4.90
28	4.9100	53⅛	12.70 @12.75	30⅛	3.85 @3.90	3.70 @3.72½	4.90 @4.95	4.75 @4.80
29	4.9100	52⅛	12.70 @12.75	30⅛	3.85 @3.90	3.70 @3.72½	4.85 @4.90	4.70 @4.75

The quotations herein given are our appraisal of the markets for copper, lead spelter and tin based on wholesale contracts; and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.15c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumer. To reduce to New York basis we ded uct an average of 0.15c. representing delivery charges. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic; of casting copper 0.15 to 0.25c. below. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb., are: St. Louis-New York, 15½c.; St. Louis-Chicago, 6c.; St. Louis-Pittsburgh, 12½c.; Chicago-Baltimore, 10½c.; Chicago-New York, 13½c.; New York-Bremen or Rotterdam, 15c.; New York-Havre, 16 @ 17½c.; New York-London, 16c.; New York-Hamburg, 18c.; New York-Trieste, 22c.

LONDON

July	Silver	Copper				Tin		Lead		Zinc	
		Spot		3 Mos.	Best Sel'td	Spot	3 Mos.				
		£ per Ton	Cts. per Lb.					£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
23	24 11/16	60	13.04	60 7/16	64¾	143⅜	144½	19	4.13	21⅝	4.70
24	24⅝	59¾	12.98	60½	64½	140¾	142½	18⅞	4.05	21⅝	4.70
25	24 7/16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
27	24 5/16	58¾	12.76	59½	63	136½	138	18⅜	4.02	21⅛	4.70
28	24 7/16	58½	12.66	59⅜	63	137	138⅜	18⅝	4.05	21⅛	4.70
29	24	57¼	12.44	58¼	62⅛	138¼	138⅜	18¾	4.07	21⅛	4.73

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latte being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26¼c. = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21¾c.

Quicksilver—The market has been quiet and prices rather easy. New York quotation is $36 per flask of 75 lb., with 52@53c. per lb. for small lots. San Francisco, $36 per flask, with about $2 less quoted for export. London price is £6 15s. per flask, with £6 12s. 6d. quoted by second hands.

Nickel—Quotations for ordinary forms—shot, blocks, or plaquettes—are 40@45c. per lb., according to size of order and quality. Electrolytic nickel is 5c. per lb. higher.

Minor Metals—Quotations for **Bismuth** are $1.80 per lb. for imported, $1.72 for metal from native ores—**Cadmium,** 750 marks per 100 kg.—81c. per lb.—at works in Germany—**Magnesium,** $1.50 per lb., New York—**Selenium,** $3@3.25 per lb. for lots of 100 lb. or over, and $5 per lb. for small quantities.

Exports from Baltimore for the week included 220 lb. selenium to Hamburg, Germany.

Gold, Silver and Platinum

Gold—Although the European markets are reported much disturbed by the war scare, no premium is reported paid on the open market in London, the price of gold remaining at 77s. 9d. for bars. In New York $8,100,000 is reported taken for export to Paris and $15,000,000 for London. It is probable that more will go, as there is a strong demand abroad, and New York is just now the most available market.

Imports of Gold in Great Britain six months ended June 30 were £28,934,112; exports, £22,364,842; net imports, £6,569,270, against £6,534,195 last year.

Iridium—On a moderate demand this metal is steady at $76@79 per oz., New York.

Platinum—The market continues quiet and steady here. Current quotations are unchanged at $43@44 per oz. for refined platinum and $46a51 per oz. for hard metal.

Our Russian correspondent writes under date of July 16 that the market is weak, with no sales reported. Stocks have increased, but are firmly held and no concessions are offered. Quotations at Ekaterinburg are 9.50 rubles per zolotnik for crude metal, 83% platinum; at St. Petersburg for the same grade, 36,400 rubles per pood. These prices are equal to $35.72 and $35.67 per oz., respectively.

Silver—The market has fluctuated wildly this week owing to the general disorganized conditions of financial centers. The market for silver has depended on China—one day China Banks selling freely and the next day buying silver. The China market has been ruled by speculators. Indian Bazaars have bought moderately. The market closes at 24d. in London, disorganized and with tendency weak.

Shipments of silver from London to the East, Jan. 1 to July 16, as reported by Messrs. Pixley & Abell:

	1913	1914	Changes
India	£4,045,000	£3,946,000	D. £99,000
China	427,000	40,000	D. 387,000
Total	£4,472,000	£3,986,000	D. £486,000

There have been no exports to China since early in the year; in fact, that country has been a seller rather than a buyer for some time.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—July 25

The base price paid this week for 60% zinc ore was $39@40 per ton. The base price paid for 80% lead ore was $47@48 per ton.

SHIPMENTS WEEK ENDED JULY 25

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	2,858,860	140,790	502,400
Year	86,168,340	3,076,500	22,252,370

Shipped during week to separating plants, 3,168,980 lb. zinc ore.

JOPLIN, MO.—July 25

Blende sold as high as $41.50, the assay base price being $38.50@40 and the metal base $37.50@38.50 per ton of 60% zinc. Calamine is $21@22 per ton of 40% zinc. The average selling price of all grades of zinc is $37.20 per ton. No sale of lead higher than $47 per ton is reported, the base continuing at $46 per ton of 80% metal content, and the average of all grades is $44.80 per ton.

Correct price quotations are hard to make tonight for the reason that the variations are unusual and unique. For instance, ores usually quotable on a metal base, carrying high iron, sold at $41 on an assay base, and ores of 58% zinc and 2% iron sold on a $40 assay base, and yet the best grades sold at $38.50 and $39. It is rumored that three more mines in the Webb City area will close down tonight.

SHIPMENTS WEEK ENDED JULY 25

	Blende	Calamine	Lead	Values
Totals this week..	11,089,820	434,530	1,697,450	$253,490
Totals 7 months.	308,619,810	22,183,430	52,744,240	7,541,165

Blende value, the week, $209,060; 7 months, $6,028,870.
Calamine value, the week, $5400; 7 months, $251,605.
Lead value, the week, $39,030; 7 months, $1,260,695.

IRON TRADE REVIEW

NEW YORK—July 29

The general tone of the iron and steel markets shows an improvement which was hardly to be expected at this season, as July is ordinarily a dull month.

New business is increasing and the mills are working up gradually to a higher percentage of activity than they have shown for some time past.

The advances reported last week in sheets, bars and wire seem to be generally adopted and maintained and have not affected the volume of new business.

Structural steel demand is improving as more building contracts come into the market. Building generally is improving and is on a larger scale.

The pig-iron market is rather behind the rest. Several steel works stacks have been blown in, but the active merchant furnaces are not increasing in number.

The United States Steel Corporation makes the following statement for the quarter ended June 30, net earnings being the surplus over working expenses and ordinary renewals:

	1913	1914
April	$13,072,710	$6,920,879
May	14,554,566	6,845,823
June	13,592,537	6,690,894
Net earnings for quarter	$41,219,813	$20,457,596
Subsidiary company charges		$5,646,170
Interest and sinking funds		7,317,963
Total charges		$12,958,133
Surplus for the quarter		$7,499,463
Dividends declared		12,658,700
Deficit		$5,199,237

The usual dividends were declared of 1¾% on preferred and 1¼% on common stock. The total net earnings for the half year ended June 30 were $38,451,977. The surplus for the half year was $11,448,881 less than the dividends declared.

PITTSBURGH—July 28

Earnings of the Steel Corporation in the second quarter, just reported at $20,457,596, an increase of $2,463,215 over the first quarter, were much larger than expected, as little if any increase had been predicted. While the earnings of ore transportation companies in May and June may have contributed a part of the increase, it is evident that shipments of steel were larger in the second quarter.

The advance in bars, plates and shapes from 1.10c. to 1.15c., made at the beginning of last week by the leading mills in western Pennsylvania and Ohio, has proved effective. The smaller mills have conformed, and even in the Chicago district there have been advances.

Actual shipping orders for steel products received this month are fully equal to the total of June, which makes an excellent showing, as July is usually very much behind June in bookings. The volume of contract business in July has shown a large increase over June, even though the mills are limiting contracts to early deliveries, except at advanced prices.

Business in manufactured steel, such as bolts and nuts, rivets, spikes, shafting, etc., has shown some increase in the past month over June. One large rivet interest reports an increase of 50% in actual shipping orders.

The steel mills are running at an average of 65% of capacity, this being if anything a slightly better rate than obtained in June. Bookings of shipping orders for sheets have been as heavy in July as in June, while contracting has shown a considerable increase. Sheet production in July has been between 50 and 55% of full capacity, many mills being off for repairs.

Pig Iron—There has been an increase in buying of foundry iron of late, and some sellers have found the whole month of July better than June in tonnage booked, while June was better than May or April. Prices on foundry iron are well maintained, and only a few furnaces are selling at the minimum of $13, furnace. Most consumers require several brands to make their mix, and sales of limited tonnages have been effected at $13.25 and $13.50. We quote: Bessemer,

$14; basic, $13; malleable, $13 to $13.25; No. 2 foundry, $13 to $13.50; forge, $12.50 to $13, at Valley furnaces; 90c. higher delivered Pittsburgh.

Ferromanganese—The market remains at $37 for German and $38 for English, at Baltimore, with $2.16 freight to Pittsburgh. While a war involving Russia, now seriously threatened, might decrease seriously the supply of ore from southern Russia, sellers are still willing to contract for early 1915 deliveries at present prices.

Steel—The open market in billets and sheet bars continues very quiet, supplies being arranged under existing contracts, with private adjustment of price. We quote billets at $19 and sheet bars at $19.50, f.o.b. maker's mill, Youngstown, and billets at $19.50 and sheet bars at $20, f.o.b. maker's mill, Pittsburgh. Rods are about $25, Pittsburgh, and very quiet.

FOREIGN IRON

German Steel Production five months ended May 31, in metric tons:

	Basic	Acid	Total
Converter	4,527,943	42,976	4,470,919
Openhearth	2,949,916	162,110	3,112,026
Direct castings	102,269	45,243	147,512
Crucible	.....	37,467	37,467
Electric	.....	41,990	41,990
Total	7,480,128	329,786	7,809,914

No comparisons are possible, as the make of steel has not been reported monthly until this year.

German Foreign Trade in Iron and Steel and manufactures thereof, five months ended May 31, in metric tons:

	Exports	Imports	Excess
Iron and steel	2,731,517	222,593	Exp. 2,508,924
Machinery	225,993	40,063	Exp. 185,930
Total	2,957,510	262,656	Exp. 2,694,859
Total, 1913	2,947,455	302,026	Exp. 2,645,424

Increase in exports was 10,055 tons, or 0.3%, but there was a decrease of 39,370 tons, or 13%, in imports.

IRON ORE

Shipments of Lake Superior ore are still slow, and few ore boats are in commission outside of those owned by steel and mining companies.

Imports at Baltimore for the week included 6300 tons manganese ore from Bombay, India, and 5900 tons from Batum, Russia.

COKE

Connellsville Coke—The coke market is extremely quiet. Furnaces in blast are well covered, though a few contracts will expire Sept. 1. A few idle furnaces have been considering the question of getting into blast and piling some iron, but their negotiations for coke are not being prosecuted with any vigor. We quote: Prompt furnace, $1.75; contract furnace, $1.85@2; prompt foundry, $2.25@2.35; contract foundry, $2.35@2.50, per net ton at ovens.

Fuel Exports of Great Britain six months ended June 30, long tons:

	1913	1914	Changes
Coal	35,526,235	34,586,938	D. 939,297
Coke	499,670	517,609	I. 17,939
Briquettes	1,022,232	1,044,360	I. 22,128
Steamer coal	10,087,037	10,182,157	I. 95,120
Total	47,135,174	46,331,064	D. 804,110

Imports of coal for the half year were only 13,534 tons in 1913, and 15,775 this year.

CHEMICALS

NEW YORK—July 29

The general market shows no change and remains quiet, as is usual at this season.

Arsenic—The market is quiet, with only a moderate demand. The producers' agreement still holds and there is no change in prices, $3 per 100 lb. being named for both spot and futures.

Copper Sulphate—Business is fair, sales running about as usual. Prices are unchanged. Quotations are $4.50 per 100 lb. for carload lots and $4.75 per 100 lb. for smaller parcels.

Nitrate of Soda—Trade in this article is fair for the season. There is a good deal of talk about curtailment of production by the Chilean producers, but so far it has not affected the market here. Prices are unchanged at 2.10c. per lb. for spot and 2.07½c. for futures.

Pyrites—Imports at Baltimore for the week included 7705 tons pyrites from Huelva, Spain.

PETROLEUM

Oil production in California in June is reported at 9,431,863 bbl.; deliveries, 8,816,610 bbl.; stocks June 30 were 52,248,329 bbl. There were 47 new wells completed during the month.

Exports of mineral oils from the United States in June were 216,563,850 gal. For the six months ended June 30 the total exports were 962,474,296 gal. in 1913 and 1,119,082,200 in 1914, an incerase of 156,607,904 gal., or 16.3%, this year.

NEW CALEDONIA ORES

Shipment of ores from New Caledonia as reported by the "Bulletin du Commerce," of Noumea, for the five months ended May 31 included 35,580 metric tons of nickel ore, 920 tons of cobalt ore and 22,954 tons chrome ore. Shipments of metals included 1575 tons nickel matte and 24 tons cobalt matte.

COPPER SMELTER'S REPORT

This table is compiled from reports received from the respect ve compan es except n the few cases noted (by aster sl) as est mated, together w th the reports of the U. S. Dept. of Commerce as to mported material, and in the main represents the crude copper content of blister copper, in pounds. In these cases where the copper contents of ore and matte are reported, the copper yield then is reckoned at 97+. In computing the total American supply duplications are excluded.

	March	April	May	June	July
Alaska shipments.	2,069,960	1,279,537	585,387	1,114,758	.....
Anaconda	23,800,000	22,900,000	23,500,000	23,800,000	.....
Arizona, Ltd.	3,286,000	3,570,000	3,092,000	3,742,000	.....
Copper Queen	7,637,042	7,562,723	8,388,203	7,613,719	.....
Calumet & Ariz.	5,875,000	5,450,000	5,495,000	4,630,000	.....
Chino	5,399,814	5,926,591	5,496,875	5,486,419	.....
Detroit	1,973,725	1,790,926	2,105,034	2,129,100	.....
East Butte	1,546,180	1,178,000	1,179,762	1,215,323	.....
Giroux	287,980	45,948	429,553	.....	.....
Mason Valley	1,250,000	862,000	916,000	.....	.....
Mammoth	1,800,000	1,850,000	1,750,000	1,725,000	.....
Nevada Con.	5,218,257	4,880,043	4,929,598	4,483,175	.....
Ohio	97,520	610,518	625,000	.....	.....
Old Dominion	997,000	2,779,000	3,302,000	2,937,000	.....
Ray	6,036,908	6,089,362	6,300,817	6,039,710	.....
Shannon	1,082,000	1,012,000	1,056,000	.....	.....
South Utah	406,381	247,641	55,394	.....	.....
Tennessee	1,262,184	1,370,800	1,336,950	.....	.....
United Verde*	3,100,000	3,000,000	3,100,000	2,900,000	.....
Utah Copper Co.	12,323,493	12,739,757	13,208,483	12,870,063	.....
Lake Superior*	11,000,000	13,000,000	12,500,000	16,000,000	.....
Non-rep. mines*	8,200,000	8,000,000	8,200,000	8,000,000	.....
Scrap, etc.	2,500,000	2,500,000	2,500,000	2,500,000	.....
Total prod.	169,649,444	108,644,846	110,082,077	.....	.....
Imp., bars, etc.	22,675,605	17,043,191	19,081,487	.....	.....
Total blister	132,326,049	125,688,037	129,153,564	.....	.....
Imp. ore & matte.	7,029,646	10,400,122	10,586,506	.....	.....
Total Amer.	139,355,695	136,088,159	139,750,070	.....	.....
Miami†	3,361,100	3,130,772	3,347,000	3,125,750	.....
Shattuck-Arizona	1,136,458	1,386,594	1,353,043	1,225,987	.....
Brit. Col. Cos;					
Granby	1,775,852	1,692,102	1,669,333	.....	.....
Mexican Cos.:					
Bolco†	2,535,689	2,201,720	2,213,120	2,204,720	.....
Cananea	4,260,000	2,632,000	2,222,000	.....	.....
Moctezuma	2,882,884	2,654,926	2,834,616	3,370,800	.....
Other Foreign:					
Braden, Chile	1,810,000	2,720,000	2,480,000	741,440	.....
Cape Cod., S. Af.	660,800	468,160	582,400	732,480	.....
Kyshtim, Russia	.....	.....	.....	.....	.....
Spassky, Russia	896,000	904,960	907,200	.....	.....
Exports from					
Chile	6,944,000	9,072,000	7,616,000	7,840,000	.....
Australia	8,176,000	7,168,000	8,400,000	5,712,000	.....
Arrivals–Europe†	17,572,800	17,299,520	13,558,720	19,040,000	.....

†Bolco copper does not come to American refiners. Miami copper goes to Cannea for treatment, and reappears in imports of blister.

† Does not include the arrivals from the United States, Australia or Chile.

COPPER STATISTICS

Month	United States: U.S. Refin'y Production	United States: Deliveries, Domestic	United States: Deliveries, for Export	Visible Stocks: United States	Visible Stocks: Europe	Visible Stocks: Total
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
VIII'13	131,632,362	73,649,801	73,263,469	53,594,945	66,420,480	120,015,385
IX.	131,401,229	66,836,897	73,085,275	38,314,037	63,716,800	102,030,837
X.	139,070,481	68,173,720	68,123,473	29,793,094	53,625,600	83,418,692
XI.	134,087,708	48,656,858	70,067,803	32,566,382	48,787,200	81,353,582
XII.	138,990,421	21,938,570	73,542,413	47,929,429	46,592,000	94,521,429
Yr., '13	1,622,450,829	767,261,760	869,062,784	.....	.....	.....
I, 1914.	131,770,274	47,956,935	87,955,501	91,438,867	53,916,800	145,355,667
II.	122,561,007	47,586,657	83,899,183	87,296,685	50,108,800	137,405,485
III.	145,651,982	69,852,349	89,562,166	78,371,852	47,376,000	125,747,852
IV.	151,500,531	63,427,633	82,345,216	64,609,319	46,435,200	111,044,519
V.	142,308,287	55,592,170	72,710,477	70,337,001	52,371,200	122,708,201
VI.	141,345,571	46,227,353	73,350,196	84,342,641	61,062,400	145,405,041
VII.	.....	.....	.....	106,110,663	64,220,800	170,331,463
VIII	.....	.....	.....	.....	.....	.....

Note—Visible supplies in Europe do not include copper afloat.

Assessments

Company	Delinq.	Sale	Amt.
Andes, Nev.	Aug. 10	Aug. 31	$0.03
Aurora-Sampson, Ida.	July 18	Aug. 18	0.002
Buffalo, Mon	Aug. 2	Sept. 2	0.004
Challenge Cons., Nev.	July 21	Aug. 11	0.05
Emerald, Utah	July 15	Aug. 18	0.0033
Enterprise, Ida.	July 31	Aug. 17	0.002
Evergreen, Utah	July 23	Aug. 22	0.01
Exchequer, Nev.	Aug. 13	Sept. 3	0.02
Federal-Ely, Nev.	July 20	Aug. 21	0.005
Four Timbers, Wash.	July 29	Aug. 29	0.0015
Great Western, Nev.	Aug. 10	Aug. 31	0.01
Hamburg-American, Ida. post'd	.....	Aug. 6	0.001
Holy Terror, Ida.	July 15	Aug. 15	0.0005
Jack Waite, Ida.	July 21	Aug. 18	0.01
Macnamara, Nev.	July 27	Aug. 17	0.03
Moonlight, Ida.	July 13	Aug. 20	0.005
Nabob, Ida.	July 20	Aug. 17	0.005
New Hope, Ida.	July 13	Aug. 13	0.002
North Bunker Hill, Ida.	July 18	Aug. 22	0.002
North Star, Ida.	July 10	Aug. 8	0.0015
O. K., Utah	Aug. 17	Sept. 2	0.005
Old Evergreen, Utah	July 23	Aug. 22	0.01
Oreano, Ida.	July 24	Aug. 24	0.002
Paymaster, Ida.	July 15	Aug. 12	0.002
Reeds Peak, Utah	July 6	Aug. 10	0.005
Smuggler, Utah	July 11	Aug. 11	0.005
Spider, Utah	July 21	Aug. 18	0.0025
Sunrise, Ida.	July 14	Aug. 24	0.002
Wasatch, Utah	July 27	Aug. 31	0.05
Wasatch-Utah, Utah	July 13	Aug. 17	0.01
West Century, Utah	Aug. 2	Aug. 24	0.005

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1912	1913	1914	1912	1913	1914
January	56.260	62.938	57.572	25.887	28.983	26.553
February	59.043	61.642	57.506	27.190	28.357	26.573
March	58.375	57.870	58.067	26.875	26.669	26.788
April	59.207	59.490	58.519	28.284	27.416	26.958
May	60.880	60.361	58.175	28.038	27.825	26.704
June	61.290	58.990	56.471	28.215	27.199	25.948
July	60.654	58.721	.....	27.919	27.074	.....
August	61.606	59.293	.....	28.375	27.335	.....
September	63.078	60.640	.....	29.088	27.986	.....
October	63.471	60.793	.....	29.299	28.083	.....
November	62.792	58.995	.....	29.012	27.263	.....
December	63.365	57.760	.....	29.320	26.720	.....
Year	60.835	59.791	.....	28.042	27.576	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1913	1914	1913	1914	1913	1914
January	16.488	14.223	71.741	64.304	77.750	69.488
February	14.971	14.491	65.519	65.259	71.575	70.188
March	14.713	14.131	65.329	64.276	70.658	69.170
April	15.291	14.211	68.111	64.747	74.273	69.313
May	15.436	13.996	68.807	63.182	74.774	67.786
June	14.672	13.603	67.140	61.336	70.821	66.274
July	14.190	.....	64.166	.....	69.446	.....
August	15.400	.....	69.200	.....	74.313	.....
September	16.328	.....	73.125	.....	78.614	.....
October	16.337	.....	73.383	.....	79.250	.....
November	15.182	.....	68.275	.....	73.825	.....
December	14.224	.....	65.223	.....	69.583	.....
Year	15.269	.....	68.335	.....	73.740	.....

New York, cents per pound, London, pounds sterling per long ton.

TIN

Month	New York		London	
	1913	1914	1913	1913
January	50.298	37.779	238.273	171.905
February	48.766	39.830	220.140	181.556
March	46.832	38.038	213.615	173.619
April	49.115	36.154	224.159	163.963
May	49.038	33.360	224.143	150.702
June	44.820	30.577	207.208	138.321
July	40.260	.....	183.511	.....
August	41.582	.....	188.731	.....
September	42.410	.....	193.074	.....
October	40.462	.....	184.837	.....
November	39.810	.....	180.869	.....
December	37.635	.....	171.786	.....
Av. year	44.252	.....	206.279	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	4.321	4.111	4.171	4.011	17.114	19.665
February	4.325	4.048	4.175	3.937	16.550	19.606
March	4.327	3.970	4.177	3.850	15.977	19.651
April	4.381	3.810	4.242	3.688	17.597	18.225
May	4.342	3.900	4.226	3.808	18.923	18.503
June	4.325	3.900	4.190	3.810	20.226	19.411
July	4.353	.....	4.223	.....	20.038	.....
August	4.624	.....	4.550	.....	20.406	.....
September	4.698	.....	4.579	.....	20.648	.....
October	4.402	.....	4.253	.....	20.302	.....
November	4.293	.....	4.146	.....	19.334	.....
December	4.047	.....	3.929	.....	17.798	.....
Year	4.370	.....	4.238	.....	18.743	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	6.931	5.262	6.854	5.112	26.114	21.533
February	6.239	5.377	6.089	5.228	25.338	21.413
March	6.078	5.250	5.926	5.100	24.605	21.460
April	5.641	5.113	5.491	4.963	25.313	21.569
May	5.406	5.074	5.256	4.924	24.583	21.393
June	5.124	5.000	4.974	4.850	22.143	21.345
July	5.278	.....	5.128	.....	20.592	.....
August	5.658	.....	5.508	.....	20.706	.....
September	5.694	.....	5.444	.....	21.148	.....
October	5.340	.....	5.188	.....	20.614	.....
November	5.229	.....	5.083	.....	20.581	.....
December	5.156	.....	5.004	.....	21.214	.....
Year	5.648	.....	5.504	.....	22.746	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1913	1914	1913	1914	1913	1914
January	$18.15	$14.94	$17.35	$13.23	$18.59	$13.90
February	18.15	15.06	17.22	14.12	18.13	14.09
March	18.15	15.07	16.96	13.94	17.53	14.18
April	17.90	14.90	16.71	13.90	16.40	14.10
May	17.68	14.90	15.80	13.90	15.40	14.23
June	17.14	14.90	15.40	13.90	15.10	13.97
July	16.31	14.90	15.13	13.90	14.74	13.96
August	16.63	.....	15.00	.....	14.88	.....
September	16.65	.....	15.04	.....	14.93	.....
October	16.60	.....	14.61	.....	14.80	.....
November	16.03	.....	13.91	.....	14.40	.....
December	15.71	.....	13.71	.....	14.28	.....
Year	$17.09	.....	$15.57	.....	$15.77	.....

STOCK QUOTATIONS

COLO. SPRINGS July 28

Name of Comp.	Bid.
Acacia	.02½
Cripple Cr'k Con.	.007
C. K. & N.	.06
Doctor Jack Pot.	.06
Elkton Con.	.47½
El Paso	1.40
Findlay	.007
Gold Dollar	.03½
Gold Sovereign	.01
Golden Cycle	1.00
Isabella	.10½
Jack Pot	.05
Jennie Sample	.03
Jerry Johnson	.03½
Lexington	.004
Old Gold	.01
Mary McKinney	.50
Pharmacist	.009
Portland	1.09½
Vindicator	1.01

SALT LAKE July 28

Name of Comp.	Bid.
Beck Tunnel	.03¼
Black Jack	.05
Cedar Talisman	.00½
Colorado Mining	.11½
Crown Point	.01½
Daly-Judge	5.00
Gold Chain	.10
Grand Central	.73
Iron Blossom	1.42½
Little Bell	.12
Lower Mammoth	.00½
Mason Valley	1.00
May Day	.05½
Opohongo	.01
Prince Con.	.18½
Silver King Coal'n	2.80
Silver King Cons.	1.80
Sioux Con.	.02
Uncle Sam	.03½
Yankee	.02

TORONTO July 28

Name of Comp.	Bid.	Name of Comp.	Bid.
Bailey	.00½	Foley O'Brien	.26
Coniagas	7.00	Hollinger	17.05
Peterson Lake	.31½	Imperial	.01½
Right of Way	.02	Jupiter	.06½
T. & Hudson Bay	35.00	Pearl Lake	.02½
Timiskaming	.02	Porcu. Gold	‡.05
Wettlaufer-Lor.	.12	Preston E. D.	.01½
Big Dome	8.10	Rea	.10
Crown Chartered	‡.00¼	Swastika	.01
Dome Exten.	.08½	West Dome	.05

SAN FRANCISCO July 28

Name of Comp.	Bid.	Name of Comp.	Bid.
Comstock Stocks		Misc. Nev. & Cal.	
Alta	.06	Belmont	6.15
Belcher	.45	Jim Butler	.96
Best & Belcher	.04	MacNamara	.01
Caledonia	.53	Midway	.16
Challenge Con.	.08	Mont.-Tonopah	.55
Chollar	‡.02	North Star	.20
Confidence	.21	West End Con.	.65
Con. Virginia	.09	Atlanta	.14
Crown Point (Nev.)	.39	Booth	.03
Gould & Curry	.01	C.O.D. Con	.02
Hale & Norcross	.04	Comb. Frac.	.04
Mexican	.43	Jumbo Extension	.18
Occidental	.75	Pitts.-Silver Peak	.20
Ophir	.08	Round Mountain	.36
Overman	.26	Sandstorm Kendall	.04
Potosi	.01	Silver Pick	.05
Savage	‡.05	Argonaut	‡3.00
Sierra Nevada	.03	Brunswick Con.	1.50
Union Con.	.08	Central Eureka	.16
Yellow Jacket	.35	So. Eureka	‡1.37

N. Y. EXCH. July 28

Name of Comp.	Clg.
Amalgamated	59½
Am.Sm.&Ref.,com	60
Am. Sm. & Ref., pf.	100
Am. Sm. Sec., pf. B.	79½
Anaconda	28½
Batopilas Min.	⅛
Bethlehem Steel, pf.	82½
Chino	35½
Colo. Fuel & Iron	22½
Federal M. & S., pf.	33
Great Nor., ore., ctf.	25
Guggen. Exp.	48½
Homestake	112½
Inspiration Con.	17
Mex. Petroleum	61½
Miami Copper	20½
Nat'l Lead, com.	42
National Lead, pf.	106½
Nev. Consol.	12½
Ontario Min.	2¾
Phelps Dodge	175
Quicksilver, pf.	1½
Ray Con.	18¾
Republic I&S, com.	20
Republic I&S, pf.	81
SlossSheffi'd, com.	22½
Sloss Sheffield, pf.	81
Tennessee Copper	31½
Utah Copper	53
U. S. Steel, com.	55½
U. S. Steel, pf.	107½

BOSTON EXCH July 28

Name of Comp.	Clg.
Adventure	1
Ahmeek	265
Alaska Gold M.	23½
Algomah	.90
Allouez	38
Am. Zinc	13¾
Ariz. Com., ctfs.	3 11/16
Bonanza	.51
Butte-Ballaklava	2
Butte & Superior	30¼
Calumet & Ariz.	63½
Calumet & Hecla	401
Centennial	16
Cliff	1
Copper Range	32½
Daly West	2
East Butte	9½
Franklin	3¾
Granby	73½
Hancock	13
Helvetia	.30
Indiana	3
Island Cr'k, com.	47
Island Cr'k, pfd.	87½
Isle Royale	18
Keweenaw	3½
Lake	5½
La Salle	3½
Mass	4
Mayflower	4¾
Michigan	.60
Mohawk	44½
New Arcadian	3¾
New Idria Quick.	‡3½
North Butte	22½
North Lake	1½
Ojibway	.90
Old Colony	4
Old Dominion	48
Osceola	74
Quincy	54
Santa Fe	1½
Shannon	4¾
Shattuck-Ariz.	21
Superior	24
Superior & Bost.	1½
Tamarack	32
Trinity	3½
Tuolumne	.35
U. S. Smelting	33½
U. S. Smelt'g, pf.	46
Utah Apex	1½
Utah Con.	10
Victoria	1½
Winona	2¾
Wolverine	37
Wyandot	.60

N. Y. CURB July 28

Name of Comp.	Clg.
Beaver Con.	.23½
Big Four	.06
Boston Montana	‡9¼
Braden Copper	7½
B. C. Copper	1¾
Buffalo Mines	1
Can. Cop. Corpn.	2
Can. G. & S.	.08
Caribou	.68
Chambers Ferland	.12
Con. Ariz. Sm.	7/16
Cons. Nev.-Utah	‡⅛
Coppermines Cons	1½
Davis-Daly	.64
Diam'field-Daisy	.04
Ely Con.	.05½
Florence	.32
Gold Hill Con.	‡ 7/16
Goldfield Con.	1 11/16
Greene Cananea	29
Kerr Lake	5½
La Rose	13/16
McKinley-Dar-Sa.	.50
Mines of Am.	3
Mother Lode	‡.26
Nevada Hills	.30
New Utah Bingham	‡⅛
Nipissing Mines	5⅛
Ohio Copper	.29
Oro	.08½
Puebla S. & R.	2½
Stand'd Oil of N.J.	387
Stand'd Silver Lead	1⅛
Stewart	1 5/16
Tonopah	6⅛
Tonopah Ex.	2½
Tonopah Merger	.32
Tularosa	5/16
West End Ex.	.03
Yukon Gold	2⅛

BOSTON CURB July 28

Name of Comp.	Bid.
Bingham Mines	.04½
Boston & Corbin	.25
Boston Ely	.25
Butte & Lon'n Dev.	.27
Calaveras	1⅛
Calumet-Corbin	.05
Chief Cons.	.80
Corbin	.90
Cortez	.33
Crown Reserve	1½
Eagle & Blue Bell	.85
First Nat. Cop.	1 11/16
Houghton Copper	1⅛
Iron Cap Cop., pf.	.4½
Majestic	.19
Mexican Metals	.18
Nevada-Douglas	1 1/16
New Baltic	1½
Oneco	.60
Raven Copper	.12
Smokey Dev.	.15
So. Lake	3⅛
Tonopah Victor	.30
Trethewey	.09¾
United Verde Ext.	.71

LONDON July 17

Name of Comp.	Clg.
Camp Bird	£0 8s 3d
El Oro	0 13 6
Esperanza	0 14 4½
Mexico Mines	4 17 6
Oroville	0 10 9
Santa Gert'dis.	0 11 3
Stratton's	0 0 6
Tomboy	1 1 3

‡Last Quotations.

The Mining Index

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COPPER

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25,841—ARIZONA COPPER CO.—New Smelting Works of Arizona Copper Co. Richard H. Vail. (Eng. and Min. Journ., June 27 and July 4; 9¾ pp., illus.) 20c.

25,842—AUSTRALIA—The Wallaroo and Moonta Mines. (Min. and Eng. Rev., May and June, 1914; 14 pp., illus.) 80c.

25,843—CALIFORNIA—Copper Mining in Shasta County, California. L. H. Eddy. (Eng. and Min. Journ., June 27, 1914; 1¼ pp., illus.) 20c.

25,844—CALIFORNIA—The Geology and Ore Deposits of the Bully Hill Mining District, California. A. C. Boyle, Jr. (Bull. A. I. M. E., June, 1914.) Discussion on paper previously indexed.

25,845—CALUMET AND ARIZONA'S NEW SMELTING WORKS at Douglas, Ariz. Richard H. Vail. (Eng. and Min. Journ., July 18, 1914; 5 pp., illus.) 20c.

25,846—CLASSIFICATION at Miami. (Min. and Sci. Press, June 27, 1914; 1 p., illus.) 20c.

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